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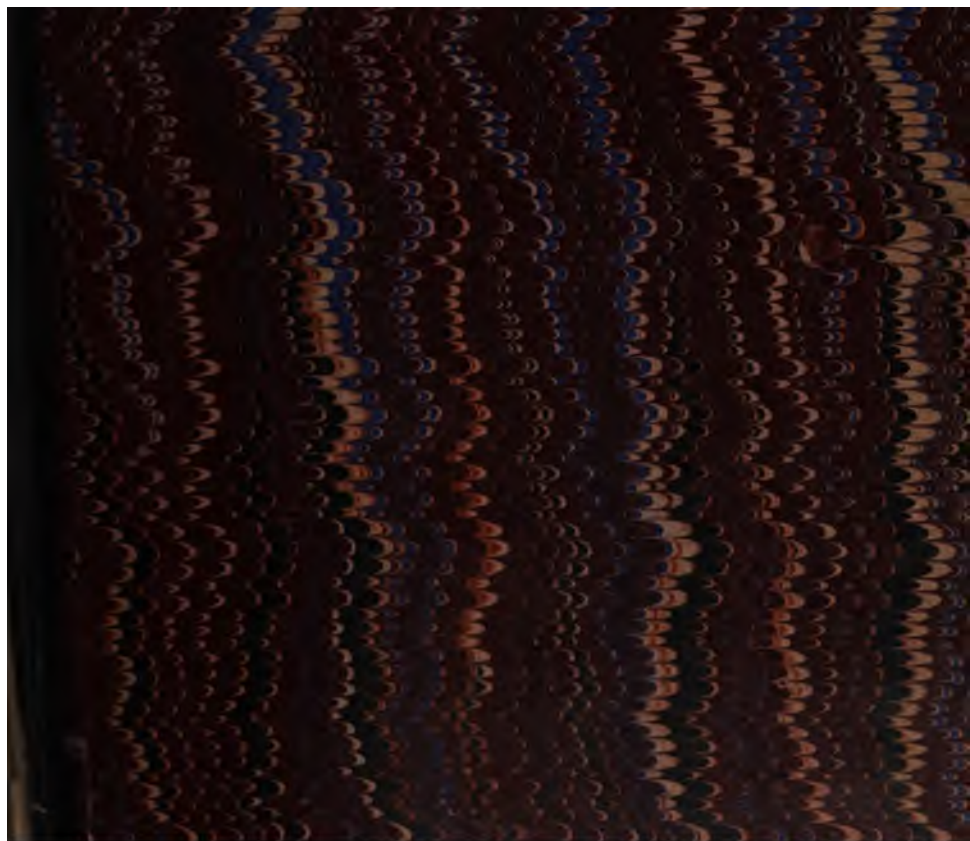
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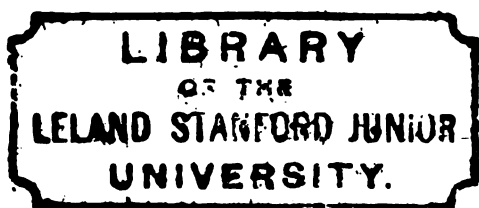
ACADEMY OF NATURAL SCIENCES

OF

PHILADELPHIA.

1867.

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1867.



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ERRATUM.

On page 12, omit from foot of column entitled *Spheno-parietal suture* the name *Troglodytes gorilla*, and insert it at the head of column entitled *Temporo-frontal suture*.

LIST OF CONTRIBUTORS,

With references to the several Articles contributed by each.

| | |
|--|-----|
| Cassin, John. A third Study of the Icteridæ..... | 45 |
| A Study of the Rhamphastidæ..... | 190 |
| Fasti Ornithologiæ, No. III..... | 212 |
| Cope, E. D. On <i>Euclastes</i> , a genus of extinct <i>Cheloniidæ</i> | 39 |
| An addition to the Vertebrate Fauna of the Miocene period, with a synopsis of the extinct Cetacea of the United States..... | 138 |
| ✓ On the genera of Fresh water Fishes <i>Hypsilepis</i> , Baird, and <i>Photogenis</i> , Cope, their species and distribution..... | 156 |
| A Review of the species of <i>Amblystomidæ</i> | 166 |
| On the Habits of a Tipulideous Larva..... | 222 |
| Coues, Elliott. Notes on a Collection of Mammals from Arizona..... | 133 |
| Elliot, D. G. Description of an apparently new species of Owl, of the Genus <i>Scops</i> | 99 |
| Ennis, J. The Necessity and Velocity of Nebular Rotation..... | 87 |
| The Mechanical Theory of Solar Heat..... | 226 |
| Hill, Richard. Note on <i>Geotrygon sylvatica</i> , Gosse..... | 130 |
| Lawrence, Geo. N. Notes on certain Birds of New Grenada, with descriptions of new species..... | 94 |
| Descriptions of Five New Species of Central American Birds..... | 232 |
| Lea, Isaac. On two new Minerals from Chester County, Pa..... | 44 |
| Descriptions of five new species of <i>Unionidæ</i> and one <i>Paludina</i> of the United States..... | 81 |
| Linneecum, Dr. Gideon. The Cutting Ant of Texas— <i>Oecodoma Texana</i> , Buckley..... | 24 |
| Lyman, Benj. S. On the Great Carboniferous Conglomerate in Sullivan County, Pa..... | 125 |

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PROCEEDINGS
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ACADEMY OF NATURAL SCIENCES
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PHILADELPHIA.
1867.

Jan. 1st.

MR. VAUX, Vice-President, in the Chair.

Twenty-nine members present.

The following deaths were announced :

Edward F. Sanderson, Esq., Member ; and Rev. Stephen Elliott, of Georgia, and Prof. Geo. W. Featherstonhaugh, of Havre, France, Correspondents.

Jan. 8th.

The President, DR. HAYS, in the Chair.

Thirty-six members present.

Jan. 15th.

MR. VAUX, Vice-President, in the Chair.

Twenty-nine members present.

Jan. 22d.

MR. VAUX, Vice-President, in the Chair.

Thirty-four members present.

Jan. 29th.

The President, DR. HAYS, in the Chair.

Twenty-seven members present.

Dr. H. C. Wood tendered his resignation as Recording Secretary.

The following gentlemen were elected members :

J. E. Farnum, W. H. Stevens, Edw. B. Edwards, Dr. James Levick, Charles Gibbons, John B. Austin, Wm. S. Baird, Edwin Greble, Walter B. Smith, C. F. Haseltine and Wilson M. Jenkins.

1867.]

The following were elected correspondents :

Prof. O. C. Marsh, New Haven, Conn., and Prof. Wm. H. Brewer, New Haven, Conn.

Pursuant to the By-Laws, an election of members of the Standing Committees for the ensuing year was to be held, but was deferred until the next meeting for business.

On favorable report of the committee the following paper was ordered to be published :

On a new genus in HOMOPTERA,—(Section Monomera.)

BY HENRY SHIMER, M. D.

Characters for a supposed new Family.

DACTYLOSPHÆRIDÆ, Shimer.

Wings four, carried flat on the back in repose.

Antennæ few, jointed.

Tarsi composed of one joint, terminated by two claws, and from two to six *digituli*.*

Honey-tubes none; otherwise resembling *Aphidæ*.

DACTYLOSPHÆRA. New genus.†

Male—Anterior wing with one one-branched discoidal, and a stigmatic nervure; posterior wing with no discoidal.

Female—Apterous, body thick, clumsy, subellipsoidal.

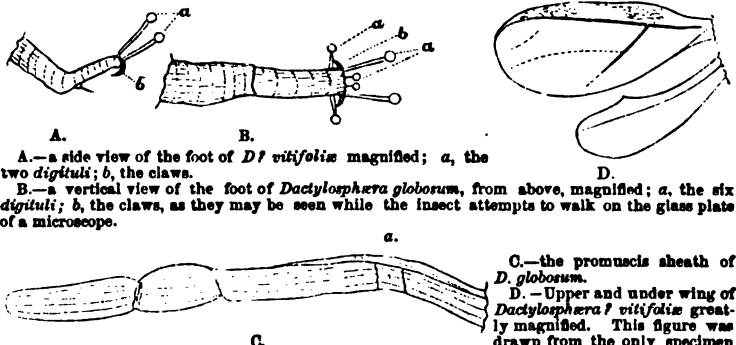
Common Characters—Antennæ 3-4 jointed. Tarsi, six digituli. Promusci sheath four-jointed,

DACTYLOSPHÆRA GLOBOSUM, n. sp.

Inhabits galls on the Pig-nut Hickory, (Carya glabra.)

Male—Abdomen and prothorax orange-yellow; mesothorax, head and eyes, blackish; legs and antennæ dark cinereous. Wings hyaline, broad, somewhat overlapping as they lie horizontally on the back. Anterior wing, even-

* I suggest this name, *digituli*, from the Latin *digitulus*, a small finger or toe, for these remarkable organs; it appears to me appropriate, because they are arranged around the foot somewhat like the toes of an animal.



A.—a side view of the foot of *D? vitifoliae* magnified; a, the two *digituli*; b, the claws.

B.—a vertical view of the foot of *Dactylosphæra globosum*, from above, magnified; a, the six *digituli*; b, the claws, as they may be seen while the insect attempts to walk on the glass plate of a microscope.

C.—the promusci sheath of *D. globosum*.

D.—Upper and under wing of *Dactylosphæra vitifoliae* greatly magnified. This figure was drawn from the only specimen

I have remaining, (from the Clinton grape gall.) The dotted lines in the anterior wing are what I saw under the microscope in the recent specimen; the shading between the costal and subcostal nerves represents a hazy appearance, as I saw it under the microscope. The vein in the posterior wing is very obscure, but I saw it with an excellent simple lens.

† From *δακτυλος*, a finger or toe, and *σφαῖρα*, a globe, on account of the slender globe-ended appendages of the tarsi,—*digituli*.

[Jan.

ly rounded on the posterior margin; anterior margin rather straight, somewhat curved, convex at the middle of the stigma, apex quite broadly rounded, the wide wedge-shaped base not extending beyond the middle; stigmatic nervure nearly straight, terminating in the centre of the apex, not visible at either end. The discoidal within the middle of the wing, not visible at its outer end, somewhat convex anteriorly, its branch hyaline at its extremities; stigma honey yellow, darkest on the costal margin, the apical end lanceolate; inwardly extending to the base of the wing, all the costal space being of the same color. Posterior wing, one longitudinal vein and no discoidal. Tibiæ and tarsi with a few scattering hairs; claws paleish horn-colored, with blackish tips. Antennæ four-jointed, sublinear, 1st and 2d short and thick, the others long, the third on a narrow pedicel, which may be a small joint, fourth clavate. Length to tip of wings .07 inch; body about .025 inch long.

Female much resembling the "grape leaf louse," (*D? vitifoliae*), but smaller, the dull pointed promusci blackish at the extremity; eyes of few (about five) facets.

Eggs similar to those of the "grape leaf louse." Smaller and of a deeper yellow.

Pupa of male orange-yellow, sometimes inclined to greenish; undeveloped wings pale yellow; body somewhat elongate; abdomen pointed; antennæ linear, three-jointed, 1st thick, subglobose; 2d smaller, short, thick; 3d very long, clavate, obliquely pointed, without a spine at the apex, a spine on the inner side of the first and second joints.

Gall variable in size, often numerous in the parenchyma of the leaf, others on the veins and leaf stalks, all opening on the lower side of the leaf, with a very small orifice; smoothish, of a somewhat leathery structure, pale yellowish-green, glaucous or dark green; subglobose or sometimes somewhat irregular, without any of the mealy sugary dust within, which is common in galls of the *Aphis* family.

There is apparently a disposition among some authors to create separate species out of the insects inhabiting galls thus variable, according to their size and location. The small subglobular galls, about .09—.14 in. in diameter, in the plane of the leaf, and about .04—.06 in. in a perpendicular direction through it, are often very abundant, and when quite full of eggs I have counted about 50; the young larva usually leaves the gall as soon as hatched, and proceeds, as does the "grape leaf louse" (*D? vitifoliae*), to construct a new gall; sometimes these small galls contain several females, but I have never found males in them; the male-producing galls are larger, of various sizes, up to $\frac{1}{4}$ of an inch or even more in diameter. During the summer and autumn and former years, I have examined many of these galls, some of them are globular, others somewhat irregular. In my original studies I took notes of them as distinct species; they were on the leaf-stalks, veins, and in the parenchyma, occasionally near the border of the leaf, most frequently in the parenchyma of the leaf, close to the veins and midribs, so that at first view I was led to believe that they were originally formed in the latter, but upon dissection I found them usually entirely in the parenchyma, the gall freely separating from the veins; these were filled with eggs, larva, pupa, and imago.

The winged males were numerous, but, as the weather then was very wet, they were in an extremely bad condition, their wings adhering to the walls of the galls and to their own bodies from the excessive dampness in the galls; but among the hundreds observed I saw a number of perfect specimens. Subsequently, in more pleasant weather, I examined several dark green, more perfectly globular galls, located as those observed before, with a good supply of winged specimens in perfect condition. I made careful examination and notes as before, and found that they agreed with the former precisely and compared favorably with the former dried specimens; and furthermore, I made a careful microscopic examination of the larva in comparison with 1867.]

those in the small galls above alluded to, and I could detect no difference; both kinds existed on the same leaves frequently, and sometimes on different leaves of the same tree; other trees have numerous galls all of the small size; in none of these small galls, after the most diligent search, have I ever been able to find a winged male. The conclusion that I have arrived at is that the galls that produce the winged males develop to a larger size, so as to make room for the coming winged inhabitant, on the great principle or law of nature that provides for the wants of every creature, often in a mysterious manner. These small subglobular galls could not conveniently accommodate the winged males. The male-producing grape leaf gall, also, is very long and well developed, so far as my limited observations have extended, while galls containing fertile females are variable from large to even quite small. From my examinations of these Hickory-leaf gall insects, I never saw the males support themselves by their wings, although they attempted flight when dropped properly from the point of a needle; the atmospheric temperature then was moderately cool, which may account for their weakness. When they attempt to fly, the hook of the posterior wing clasps the thickened posterior border of the anterior wing, but not when at rest. The male of the grape leaf (*vitifolæ*) gall insect also thus made several ineffectual attempts at flight, but was not able to support its body; how this might be in a very warm sunny day I did not have the privilege of determining.

During my microscopic examinations I became convinced that the apparent enlargement of the posterior border of the anterior wing of these insects, is not a development of a nervure or a mere tumefaction of the border, but a rolling up of the margin like a scroll, which much more admirably fits it for a permanent retaining point for the hook on the anterior margin of the posterior wing.

To make a thorough examination of the feet and their appendages, the living insect is the only material from which it can be satisfactorily done. The two claws, as in the case of the "grape leaf louse," can be easily seen as the insect attempts to walk on the glass plate. The tarsi of the larva and female only have two conspicuous digituli, but the male, as it approaches the imago state, develops six; these I observed in the pupa, being the most convenient state for the examination of these organs; those in the middle, between the long or principal pair, are not always so conspicuous, but may be plainly seen under proper circumstances; more frequently they appear as one short stub-like spine.

The knobs on the extremities of the principal digituli, over the claws, are globular, while those on the middle and lateral ones are obovoid and comparatively small.

The legs, feet, etc., of the male imago are much longer than in any other state, hence they appear to be the best material for satisfactory examination, regarding the problem of one or two joints for the tarsi. While the insect was walking slowly under the microscope, I beheld, in a vertical direction, that the tarsi are composed of at least three rings or segments, none of which presented a movable joint; I then crushed the abdomen, but did not injure the thorax; by this means I brought some of the legs on the side, so that the joints moved in a plane parallel with the glass plate; this also had the advantage of confining the insect to the spot, and, as I did not injure the thorax, I had a fair opportunity of examining the tarsi for a long time, with the advantage of such motion as I desired while the insect struggled for freedom; this view of the tarsi demonstrates that they are composed of four rings soldered together, none of them gave the slightest joint-like motion; the upper ring is the most plainly distinct from the succeeding one; on the under side of the foot I beheld some constriction, but on the sides and above there is none; I observed this with great care, but saw no motion, the bending of the foot being confined entirely to the articulation of the tarsus with the tibia. I then, by way of comparison, examined, under similar circumstances,

[Jan.

the foot of a species of *Aphis*, abundant on the apple trees, and saw it composed of the same number of rings; the upper one at its union with the succeeding showed some constriction, as seen either from *above* or from the side view; moreover the motion of a joint was very satisfactorily seen, the insect sometimes bending it alone, at other times in conjunction with the tibio-tarsal joint.

Now, in view of these facts, I can see no reason for claiming two joints for the tarsi of this insect. It would be as reasonable to suppose that each primary ring was a joint, and then we would have four, which, with the digituli that might be the representatives of another joint, give five undeveloped joints—joints in embryo—the highest number in the more perfect *Insectans*; but in the case of this and other species of this family, which I have observed, all are soldered together. By extending my examinations to the tibia I found it composed of about 50 similar primary rings, each one of which was plainly widened from above downward, thus agreeing in the general structural anatomy with the tarsus. This same primary annulated structure I beheld in the antennæ of these insects, also in several species of *Aphidæ* to which I extended my observations by way of comparison.

Frequently the distal or wide end of these primary rings is prolonged into spines, &c., more or less numerous according to the species of insect. These observations give us a view of the true primary anatomical structure of the long members of insects, for this annulated structure very probably exists in the long members of all insects, although not so readily detected, in many cases, as in the translucent limbs of these insects. Furthermore, these observations lead us to be careful about pronouncing upon the number of joints in the tarsi. To designate each one of these rings as a true joint would lead us at once into inconsistencies, for any anatomist could not presume that the tibia is composed of 50 joints, or the antennæ of this insect, and many species of the *Aphidæ*, of perhaps hundreds; hence, where we behold in the tarsi precisely the same structure, we are no more justifiable in ascribing to it 4 or 5 joints, or even *two*, without beholding the motion of a joint, or the usual constriction. In view of these facts I have made extended and careful observations on the tarsi of these insects, and have become entirely satisfied that there is but *one* joint. These are my reasons for believing that these insects belong to a new family between the *Aphidæ* and *Coccidæ*.

The promusculis sheath of this insect I examined under more favorable conditions than that of the "grape leaf louse," and clearly saw four joints; and if, as I believed, there are two in close proximity, as shown in the magnified sketch at *a*, fig. C, on page 1, there are five joints, while in the latter I did not succeed in distinguishing more than three; perhaps with proper material the same arrangement may be discovered in the latter as in the former species. In *D. globosum* I had an abundance of male pupæ and winged imagoes for examination, while in the *D. vitifoliæ* I was chiefly confined to females and larvæ. The bundle of setæ I could not separate, although I made numerous examinations, with the living insect on its back, for the purpose of ascertaining positively. I often saw the insect take hold of it by grasping it between the claws and the foot, pulling and bending it in various directions, sometimes seizing it with two feet and pulling in opposite directions, yet I could not determine more than one piece.

DACTYLOSPHAERA ? VITIFOLIÆ * (The "Grape leaf louse.")

Pemphigus vitifoliæ, Fitch, 1st and 2d Reports, p. 158. Walsh, Practical Entomologist, vol. i., p. 111.

* Not wishing to multiply genera unnecessarily, I have not constructed a new genus for this insect, but my convictions are that there are characters that probably warrant its separation from *Dactylosphaera*, according to custom. The stigmatic nervure was absent in all the specimens I saw, but upon close examination with a microscope of moderate power, in one specimen I imagined that I saw part of a faint dark line in one wing, where it might be sought for. The branch of

Inhabits galls on the grape leaf, tendrils and vine.

Male.—Body moderately slender; abdomen sharply taper-pointed, with a few scattering hairs at the extremity; head short; neck thick. Body, head, legs, and antennae light yellow, the two latter palest; a broad dark band encircling the middle of the thorax. Wings membranaceous, hyaline; in repose, somewhat overlapping, rather wide or diverging behind the extremities; in the only entirely perfect specimen observed were slightly curved upwards. Anterior wing widest in the middle, subobovate; posterior margin one regular curve or arc of a circle from the base to the outer extremity; apex completely rounded and comparatively broader than I have observed of our common *Aphide*; anterior margin irregularly convex, the greatest convexity being somewhat nearer the basal extremity, where it is considerably rounded forward; a small, inconspicuous costal, and a yellowish strong subcostal nerve; one dark discoidal springing from about the basal third or fourth of the subcostal and shading off or becoming lost in the membrane before reaching the border; outlines of these nervures rather hazy, obscure, not sharply defined; a long, very obscure branch passes longitudinally from near the middle of the discoidal, in some specimens scarcely, if at all, perceptible; part of the costal space near the base, and an imperfect, undefined stigma, light fulvous. Posterior wing, small, narrow; no discoidal nerve; subcostal scarcely perceptible, somewhat near the costal. Tibiæ and tarsi with a few hairs or spines, a somewhat prominent one beneath the foot near the joint. The digituli, with their conspicuously globular extremities, arise from the extremity of the tarsi, just above the claws, and project beyond the long subcylindrical tarsi about one-half their length, and about four times the apparent length of the comparatively thick, much curved, light horn-colored claws, as held when walking; these slender, almost hair-like appendages or fingers are smooth, slightly curved downward, not tapering to the extremity, terminates in an abrupt, complete globe of about two or three times the diameter of the pedicel. Antennæ long compared with those of the female, but moderate when compared with those of some *Aphidæ*; pale whitish-yellow, inserted before the eyes, they usually appear three-jointed, (and will be thus considered when examining with a good pocket lens, and more especially in the dried specimen, where we have not the advantages of motion under the microscope, so invaluable in the living specimen.) The extreme joint being very long, and under a higher power annulated with about 25 fine grooves, the marks of the primary rings; but in

the discoidal is so very obscure as to be easily overlooked, and, being a microscopic character, might be rejected, but if retained we still have the generic characters differing from *Dactylophyes*, viz.: Anterior wing with one one-branched discoidal. Antennæ 3-8 joints. Tarsi two digituli. In case, however, the characters given above should be sufficient to separate, generically, *vitifolia* from *D. globosum*, I would propose the generic name of *Viteus* for the former.*

† I wish to be clearly understood regarding what I saw of these wing characters. Very probably they will not all be admitted as existing characters by close investigation of the dry specimens. My examinations were all made in the recent state. With a good lens the discoidal nerve can be seen not as a clear, sharply defined rib, but as an obscure, hazy, margined line; the same may be said of the subcostal nerve which, however, is much plainer, the discoidal branch not observable.

With a good compound microscope, of different increasing powers, something more can be learned in the recent state. All the veins are in an imperfect or partially developed state; the walls of the tubes are not so completely formed as to present the sharply defined lines observable in higher developed insects, and with sufficient power to discover the primitive cells, we behold them piled up on each other—great blocks of microscopic masonry—the foundations of the walls of the veins. Looking through the centre of the forming tube, the field appears more transparent, because we do not look through so great a depth of the imperfect tube walls as at the side; this central transparency of these hazy lines in the wing is, furthermore, an evidence that it is a channel for the circulation of the blood. The margins and terminations of these veins appear hazy because the cells are in a loose or diffuse state. In most insects the walls of the veins are completed, hence the ribs are clearly defined. These remarks are peculiarly adapted to the discoidal nervure, where the cells that nature has provided for the construction of the tube of the vein are to be seen to good advantage between the membranes of the wing. The branch of the discoidal is a very slender capillary tube, with similarly imperfect walls. I saw in one wing a faint trace of a capillary stigmatic nervure in a small part of its course. The subcostal nerve of the posterior wing is in the same undeveloped condition and almost capillary—microscopic. I examined, thus, every portion of the wings of my specimens, elsewhere I saw no trace of nerves, only the uniform

[Jan.

one specimen I fairly succeeded in resolving this extremity into five joints, making in all really seven joints somewhat nearly equal; first joint tumid, very short; second short and thick also, but much smaller than the first, truncately rounded at the outer end, with a somewhat prominent spine projecting from the anterior margin and a solitary capillary hair of equal length; third connected with the second by a narrow pedicel; fourth slender, small: thence the joints become gradually thicker towards the last; fifth longest, about equal to the third with its pedicel; sixth shortest excepting the basal; seventh becoming obliquely tapering towards the apex, which sustains three short spines. The pedicel, between the second and third, may be a very small joint, (of which I am convinced, giving really 8 joints in all,) but of its existence I am not certain by ocular demonstration, therefore I do not give it place as a positive character. The numerous grooves in the antennæ much resemble the line of union of very short closely embracing segments soldered together, and are doubtless primary rings of embryonic development. Length to the tip of the wings about .07 inch.

Female yellow, tumid; abdomen gradually tapering to a short point: clumsy, making little or no progress on a smooth surface, somewhat variable in size, appearing, to the naked eye, not much unlike a yellow immature grain of common purslane (*Portulaca oleracea*, L.) seed. Like the *Termite*, increasing in size and fertility as pregnancy continues; its average length being somewhere about three-hundredths of an inch; segments more conspicuous above and beneath than on the sides; the globular-ended, or knobbed hair-like digituli of the tarsi plainly seen projecting beyond all the feet about half their length, fornicate cylindraceous; also on each side of these, there is a prominent, acuminate, hair-like spine, and between them a short spine of about, or somewhat less than, half their length. Antennæ 3-jointed, transversely rugose or imperfectly annulose, nearly naked, sublinear, situated on the forehead in front of the eyes; first segment tumid or subglobose, short, of much the greatest diameter; second short, intermediate in diameter between the first and third, with a small spine anteriorly; third exceeding the first and second in length, subfusiform, the obliquely pointed apex shortly bifid; eyes small, few facets. Promusci arising from about the anterior fifth, in a thick reclining stump-like base; sheath three-jointed (?), usually lying on the breast.

Larva somewhat depressed, elongate-elliptical, in the field of view from above; moderately active, yet slow when compared with other insects; in the field of a microscope of low power it can be examined with a good degree of satisfaction before it travels beyond the field of view; color light yellow-prasinous; feet and antennæ as in the perfect female.

Egg prolate spheroidal; length about $2\frac{1}{2}$ times the width; pale greenish-white; to the naked eye visible only as a fine dust point.

Pupa of the male somewhat longer and more slender than the mature female, browner; legs longer, much more active; the short, brown, imperfect wings diverging obliquely down the sides; antennæ as in the mature female.

Gall.—The *vitifoliae* gall always opens on the *upper* side of the leaf, while the gall of *Dactylophara globosum*, on the leaf of the Pig-Nut Hickory, (*Carya glabra*), always opens on the *lower* side, and both are alike in being free from any of the sugary dust, so common among the gall-producing *Aphidæ*. It is subglobular, quite rough on the outside, and of variable size, according to the age, &c., well developed galls attaining the size of a pea. They are often very numerous, almost covering the leaf, and in many cases the leaf is destroyed before the gall becomes fully developed; occasionally they are located on the

thin cellular tissue connecting the two walls of the wing-bag. These are facts that I believe worth recording; others may receive them for what they are worth in classification. I can see here somewhat satisfactorily the same plan of neurulation, in an embryonic state, as given for the genus *Dactylophara*, and I will not be surprised if specimens yet be found in a better state of development. The wing neurulation of *Dactylophara* is synonymous with that of *Phylloxera*, (Proc. Ent. Society, vol. I., p. 297, fig. 8.) It is therefore upon the other characters that I found this genus.

1867.]

leaf stalks, tendrils and vine itself; these latter some authors are inclined to refer to a distinct species, but as they are associated with those on the leaf, and as there is no observable anatomical difference between the egg, larva and female of these and those on the leaf (as I have shown elsewhere), it is quite inconsistent to believe that there is a specific difference. The young larva leaves the gall, usually, soon after being hatched and resorts to the tender leaf as it is expanding from the bud, fixes its location, where it feeds by puncturing the leaf and sucking the juices; this irritation causes an abnormal development of the leaf and thus produces a cup or bottle-like excrescence or gall in which the insect now develops to a mother and where she resides, laying eggs, during the remainder of her life; from 50 up to even 5000 eggs may be found with her at once, and one female may be the progenitor of many millions in one season, even 10,000,000,000,000,000, as I have shown in the *Practical Entomologist*, vol. 2, page 17. Sometimes a few of the female larvæ, from some cause, appear to remain in the gall until maturity;* at other times the galls are so closely located that two or three are blended into one irregular gall, with as many primary parents. This disposition to, in a measure, form colonies, while the coccus spirit of emigration also prevails, is another evidence that this insect forms the connecting link between the *Aphidæ* and *Coccidæ*. Much might be said regarding these galls, their enemies, &c., but they have been in a measure recorded in various publications.

HOW TO CONDUCT EXAMINATIONS.

The antennæ of these insects can easily be examined with a common botanical microscope, as I have often done; for this purpose the young larva is as good or perhaps better than an old female, but it travels so rapidly that it is impossible to keep it long enough in the field of a good microscope to make a satisfactory examination of the feet—the all-important organs in family classification here; and if on the back the incessant motion of the legs, sweeping through the field of vision so rapidly, gives a very poor and unsatisfactory view. But for a thorough examination I must insist on putting the living insect under a good microscope, and although the pregnant female is a clumsy, globular looking mass, with the legs apparently so close on the body as to be nearly out of view, yet I find it the best state for examination, and it will lie on its belly, side or back, as we may place it, long enough to examine it carefully, especially when pretty cool; if we place it on the side or back we can get a very good view of the feet, and we can see to good advantage the digituli, curved from above downward, and also the movement control that the insect has over them, diverging, approximating, elevating and depressing them; under a poor glass these will be mistaken for long slender claws, but the true claws will be seen just beneath them, and when on the back or side with the leg projecting out leisurely from the body or sweeping through the field of vision, I have watched them for many hours without being able to solve the problem of one or two claws, so close does the insect keep them when they are curved in under the foot, as they always are when in these positions. But place it on its belly on the smooth glass plate, and it vainly struggles without being able to move from the spot; it thrusts out its legs, and, as might be supposed, naturally enough spreads every organ of the feet, over which it has muscular control, to aid locomotion; looking from above downward we see the long hair-like digituli, with their globular ends, sweeping over the glass plate; the globe not becoming distorted or brushed off, we are convinced that it is not a

* I would here raise the inquiry, inasmuch as winged males are so very rare, may not some of these supposed females be apterous males, especially in those perfectly round galls, apparently made by one mother, wherein we often find several apterous female like imago, usually somewhat smaller than the one original parent of the colony? Otherwise, how can we account for the fertilization of the eggs that are to pass the winter? Winged males certainly, on account of their extreme rarity, do not fertilize many; yet from appearances, their numerous enemies, their great liability to destruction from every cause, and with all their great abundance, many certainly must become fertilized from some source. This is a point yet open for investigation.

[Jan.

liquid exudation, but a true solid member of the body; its hair-like pedicel may be seen occasionally to bend, thus proving its pliability; the pedicels, as well as the globes, are translucent, and without doubt are composed of the same leathery structure as other parts of the skeleton, and in the cast skin they appear as perfect as in the living animal; these are remarkable appendages, entirely unlike anything which we ordinarily see in the anatomy of insects. Burmeister, in his admirable *Manual of Entomology*, so far as I at present have it in remembrance from thorough study some years ago, fails to observe anything of the kind, and I can only conjecture that their use is to enable this small insect to climb with safety over the down of the tender grape leaf, with which it is abundantly supplied, when the down and hairs are so long as to prevent the unguis from reaching the bark. This instrument is admirably adapted to lock firmly between the projecting hair and down of plants, and convey the insect through this forest of down with safety. The globe on the end may also possibly be a gland, secreting a viscid substance, but of this I have no ocular demonstration. On either side of these digituli we see a diverging spine nearly equalling them in length, and between them we see a short stub or spine-like body, less than half their length. I have not minutely examined this, having only seen it in the field from above; it may probably be the spurious claw—*pseudonychia* of Burmeister, or undeveloped digituli. Beneath these the claws, one on each side, can be plainly seen widely spreading on the smooth glass as the insect vainly struggles to move forward; these claws are much curved, short, and comparatively thick and strong, appearing light horn-colored under a good achromatic microscope.

With such an armor as this we cannot help viewing with admiration the wonderful adaptability of nature to the wants of so frail a creature; by the means of the four-fingered and two-clawed hand, as it were, alone, it can travel with as much safety from the parent gall, far below on the vine, up over the forests of down that it may encounter on the plant in its progress to the tender bud, as the monkey travels over the tops of the trees in the dense jungles of tropical climes; without these, amidst the atmospheric storms, it must fail to reach the tender bud, where alone it is able to construct a new gall and repeat the work of its parent and fulfil the unworthy object of its being.

While the insect is on its back, to examine the tarsi, promusci, &c., you will not fail to observe the manual dexterity displayed as it seizes hold of the promusci and setæ, with this hand-like organ, and pulls them away to one side as it struggles and kicks in the vain effort to right its position. Perfectly at home in the snug tenement—its gall—it is almost as unhappy on the hard smooth glass-plate of a microscope as a fish is on dry land, unwillingly a martyr to science.

To examine the nature of the articulations you will prefer a larva; they are very imperfect, appearing externally like a mere thinning of the leathery structure of its limbs, with no well-defined line of union between the tibia and tarsus; this dermal membrane about the joint wrinkles as it bends the organ in locomotion; the lower end of the tibia projects into a prominent heel on which it treads heavily.

I believe that the females are never winged in any season of the year, if they are in the spring they are not much used. I see here grapes, not more than one hundred yards from the vines, so completely covered with them, entirely free, and have thus remained during three summers, while another cluster of grapes taken in the early spring from among the affected ones and planted at some distance in another direction, are in like manner affected. This fact, in a measure, is confirmatory of my former conjecture, that these insects probably survive the winter in galls on the tendrils and vine stalk, or it may be occasionally that the egg, falling into small crevices in the old bark, thus passes through the winter. If there is any freezing of these eggs, the burying of the vine in the earth and snow affords them protection. Now, as the leaves are falling, many of the galls are full of eggs and very few of them are hatching, and with the 1867.]

increasing coldness of autumn it will cease altogether; soon after falling the leaf dries and consequently the gall shrinks and gapes open; thus many of the eggs can fall out on the ground around the roots, and in this way chiefly do they survive the winter. In transplanting they are conveyed with the earth around the roots. In the early warm summer weather these eggs hatch and the young louse, instinctively, resorts to the vine and ascends to the leaf in quest of food. Thus they are perpetually preserved about the once affected vine and removed from place to place in transplanting.

Their natural enemies may hold them in check, but will never subdue them. When they become too numerous to obtain a sufficient supply of their insect-food readily everywhere they die of starvation; while some of these lice are still living in security enough to continue the species. Their enemies are numerous, and I never go forth to investigate, even now at the end of long years of study, without discovering something new and interesting. Their natural history is inexhaustible; insignificant as it may seem to be, it is an object of the deepest interest when we come to the examination with our eyes open to the truths that develop around us and force themselves upon our consideration.

The winged males are very rare, among the rarest of the rare, as I have found by experience, at least in this region. I have opened more than ten thousand galls and never saw but four winged imagos; one I found late in September of last year, and three during the present autumn; two were somewhat imperfect but useful material for examination; two I took from one gall a few days ago, one of them was entirely perfect, it was an admirable specimen for examination; it enabled me to get the precise position of the wings in repose. They are very liable to be crushed or injured in opening the galls, because it is necessary to open them rapidly to make any progress, and a very little water entering a gall causes the wings to adhere, frail membranes as they are, and greatly damages them. I also found three male pupæ and a parent female and eggs in a gall. I failed to raise either of these pupæ; they soon perished after the gall was removed from the vine, refusing to leave the old drying gall for fresh ones placed beside them.

Having thus found four male imagos and seen the pupa, there appears to be no further good reason why I should longer delay the publication of my supposed new genus and family and my observations, except that I wish to forward a supply of them to learned societies, but as they are so exceedingly rare it appears like hoping against hope.

As this is a very common insect it needs a common name, and I think no better could be given it than that suggested in the *Prairie Farmer*, (Aug. 4, 1866,)—"Grape leaf louse."

Mount Carroll, Ills., Oct. 8, 1866.

NOTE.—My description and the details of my observations of these insects may appear quite prolix, but on account of the various erroneous opinions held by popular authors regarding them, I have been induced to give a pretty minute description of the insects in their *different* states, and the method of conducting my observations, so that others may the more readily verify them, from even larva and females, my only object being the development of truth.

Dr. Fitch locates them in the *Aphis* family, while Mr. Walsh classes them among the *Coccide*; they appear nearer the former than the latter. But the "grape leaf louse" certainly bears no generic resemblance to *Pemphigus* as Fitch declares, doubtless, without observation, which is hardly excusable in even the most popular writers.

For what reason, if any, Mr. Walsh could have announced, in the *Practical Entomologist*, vol. i., p. 111 and 112, that the *Vitifolix* gall "is the work of an insect, not of a plant-louse, however, as Dr. Fitch supposed, but as I have recently ascertained, of a true bark-louse belonging to the *Coccus* family;" and in further allusion to *his three gall-making bark-lice* unqualifiedly assures us that "any entomologist by examining either the *vitifolix* (insect) of Fitch, which I

[Jan.

find on the wild *Vitis cordifolia* and on the tame Clinton grape-vine, or the gall *caryævenæ* of Fitch, which I find exclusively on the leaves of the Shellbark Hickory (*Carya alba*), and the third—an undescribed gall, the size of a cabbage seed, on the leaves of the Pig-nut Hickory (*Carya glabra*) may easily satisfy himself that the mother-louse inhabiting them does not belong to the *Aphis* but to the *Coccus* Family," &c., &c., *without telling us how to become satisfied that a plainly two-clawed tarsus belongs to the Coccus family*, is quite incomprehensible, and certainly utterly at variance with their true anatomical characters. My paper discusses two of these *supposed bark-lice*, and I believe that the third is of the same character. Dr. Fitch's "rashness" is here fairly paralleled by the accuser himself, in the same paper, by "fixing the family to which a particular larva belongs," as I have abundantly demonstrated. H. S.

Feb. 5th.

MR. VAUX, Vice-President, in the Chair.

Twenty seven members present.

Feb. 12th.

The President, DR. HAYS, in the Chair.

Thirty members present.

The death of R. Kennicott, member, was announced.

Feb. 19th.

The President, DR. HAYS, in the Chair.

Forty-four members present.

The following papers were presented for publication :

"A list of introduced plants, growing in waste ground below the Philadelphia Navy Yard, &c." By Aubrey H. Smith.

"On the Habits of the Cutting Ant of Texas." By G. Lincecum.

The following deaths were announced :

William Norris, a member, on the 5th of January ; Brackenridge Clemens, M. D., of Easton, Pa., a correspondent ; Prof. Alexander Dallas Bache, a member, at Newport, R. I., on the 17th inst.

Dr. H. Allen directed the attention of the members to some features of interest in the conformation of the mammalian skull, based upon examinations of specimens in the Academy's collection.

Having noticed in the skull of a Kronian negro, in the Wistar and Horner Museum of the University of Pennsylvania, the absence of union between the greater wing of the sphenoid bone (alisphenoid) and anterior inferior angle of the parietal bone, and in its stead a union at that point between the temporal and frontal bones, he was desirous of ascertaining to what extent the variation would be found present in a series of crania. With this object examinations of the human skulls, eleven hundred in number, were made, when the variety was found present in twenty three. With these it was thought to be the result of deficient development of the great wing of the sphenoid bone, an interspace being left which was occupied by a process of the temporal sent forwards and upwards to articulate with the frontal bone.

1867.]

This was rendered probable from the occasional occurrence of Wormian bones near the site of union. In five specimens out of the twenty-three Wormian bones were found placed between the squamo-parietal and squamo-frontal sutures, but more often in the former locality, when they were often associated with similar bones situated at the temporo-occipital region. The extent of the suture was subject to much variation; in some specimens it was an inch long and well marked, in others it was reduced to a mere point. In three specimens it was found on one side, the spheno-parietal being present on the other. In yet another the temporo-frontal was seen on one side and the spheno-parietal with Wormian bones on the other.

The whole number of specimens was distributed among the varieties of men as follows:

Anglo-Saxon, Pelasgic, Swede, Chinese, Hindu, Bengalese, Mandan, Seminole Indian, Blackfoot Indian, Iroquois, and Esquimaux, each one. The remaining twelve were negro.

This observation lead to the examination of the skulls of the mammalia, the result being as follows:

| <i>Spheno-parietal suture.</i> | <i>Temporo-frontal suture.</i> |
|--------------------------------|--------------------------------|
| Simia morio, | Troglodytes niger, |
| Simia satyrus, ex, | Hylobates, |
| Semnopithecus, | Cercopithecus, ex, |
| CATARRHINI, | PLATYRRHINI, |
| LEMURIDÆ, | Bison, |
| MARSUPIALIA, | Bos, |
| CARNIVORA, | Tragus, |
| CETACEA, | Tapirus, |
| SIRENIA, | Rhinoceros, |
| RUMINANTIA, ex. | Sus, |
| Chæropsis, | Equus, |
| Hyrax, | RODENTIA, |
| Dicotyles. | EDENTATA, |
| Troglodytes gorilla, | Hypsiprymnus. |

In the anthropoid apes it was found that the temporo-frontal suture was constant in the skull of all the species excepting *S. morio* and one specimen of *S. satyrus*. Prof. Owen* mentions the spheno-parietal articulation in *S. satyrus*, and considers it a distinctive character of *Simia*; but in the skull of a young individual examined, the suture was indubitably temporo frontal. Out of seventeen specimens of *Cercopithecus* in the collection seven had the spheno-parietal articulation. In two of these it was spheno-parietal on one side, temporo-frontal on the other.

In the Ruminantia the alisphenoid was very slightly developed, the union being effected by the external angular process of the parietal growing downwards in a long falciform extension. This was seen to be a conspicuous feature in the skulls of this order. The variation noticed in Bison, Bos and Tragus, had its origin in the first two genera in the unusual development of the frontal bone backwards and outwards, reaching the temporal bone by cutting off, as it were, the descending process of the parietal. In the last, one specimen only was examined; the spheno-parietal union was complete on one side, while the temporo-frontal was but faintly determined on the other. It was thought probable that the skulls of young individuals of these genera would show upon examination the same plan of construction in this particular as others of the order.

The suture was seen to be invariable in Carnivora, Cetacea, Sirenia, Edentata and Rodentia; but inconstant among the members of Marsupialia and the Cuvierian order Pachydermata. Among the marked contrasts here observed were those between Sus and Dicotyles, Hyrax and Rhinoceros.

* Trans. Zool. Soc., vol. I., 1835, 368.

From the early obliteration of all cranial sutures in Cheiroptera and Insectivora—many young individuals of the former order were examined—nothing definite was ascertained concerning them. It is reasonable to suppose that they resemble the Carnivora.

Dr. Allen further spoke of a distinguishing feature between the skulls of the new and old world monkeys. In the former there is no bony external meatus; in the latter there is a well defined osseous tube as in man. He also invited attention to an interesting feature in the skull of a young Chimpanzee, in which it was found that the lachrymal and ethmoid bones were separated from one another by an ascending process of the orbital plate of the superior maxilla, which articulated with the internal angular process of the frontal bone. The peculiarity had not been seen in any ape, though a human skull in the collection (Esquimaux) exhibited it.

It was thought that the subject of sutures was of interest from an anatomical stand-point and might, after more extended comparison, prove of value in classification.

A letter was read from Dr. Charles M. Wetherill as follows :

Bethlehem, Pa., Feb. 16th, 1867.

WM. S. VAUX, Esq. :

Dear Sir,—Will you do me the favor to communicate to the Academy the following results, which I have reached in an investigation (not yet completed) upon the Itacolomite.

The so-called flexible character of this sandstone is universally attributed to the mica which it contains. I have succeeded, beyond a doubt, in establishing the fact that the said motion is due to innumerable ball and socket joints. This wonderful molecular grouping warrants, I think, the suggestion of "*articulites*" as a generic name for this class of sandstones. I succeeded in first observing the play of these joints upon their sections under the microscope, taken in three planes relative to the plane of stratification. It is, however, unnecessary to incur the labor of preparing such sections; the motion may be perceived with any fragment by examination with the microscope, moving the loose particles in the joints with the needle point, or removing the said particles, thus dissecting the specimens.

The joints are not similar to those observed in columns of basalt. The fragments of quartz are very small and very sharp; twenty, thirty or more of these sand particles are cemented to each other to form irregular compound molecules. The protuberances of these are engaged in the cavities of neighboring groups, and so irregular and abundant is the jointing, that a slight motion is permitted in any direction.

A long thin rod of the sandstone may be twisted, elongated, compressed longitudinally, or bent nearly equally in any direction. When suspended by its extremities, the rod takes the form of a curve which very nearly approaches a true catenary. My friend and colleague, Prof. E. W. Morgan, of the Lehigh University, is, at my request, studying the exact nature of the curve thus formed.

The specimens examined are from two localities; from Mines Geraes in Brazil, a specimen in the collection of the Smithsonian Institution; and another from Stokes Co., N. C. An analysis of the latter showed a large proportion of silicic acid, and the cement, if it be one, which unites the grains of sand, is not ferruginous, as was shown by boiling a thin section, during a considerable period, with hydrochloric acid.

I would be very much obliged to you (or to any member of the Academy,) if you would furnish me with specimens of Itacolomite from different localities for this investigation.

I have thought that the establishment of the curious molecular character of this mineral might lead to a knowledge of the physical conditions by which it was effected and perhaps throw light upon that vexed question, the origin of the diamond.

Very truly yours,

CHARLES M. WETHERILL.

1867.]

Feb. 26th.

The President, DR. HAYS, in the Chair.

Thirty-eight members present.

The resignation of Dr. H. C. Wood as Recording Secretary was accepted.

Joseph Jeanes tendered his resignation as Corresponding Secretary, which was accepted.

Resignations of membership were tendered by James Starr and J. Heintzleman, and were accepted.

A communication was received announcing the organization of the Conchological Section of the Academy, and the election of its officers.

Dr. Harrison Allen was elected Corresponding Secretary of the Academy for the remainder of the year, and Dr. S. B. Howell, Recording Secretary, for the same period.

The following were elected members :

Evan Randolph, Francis R. Cope, Joseph Patterson, Richard M. Marshall, Benjamin Marshall, John Livezey, Charles H. Borie, Thomas P. Cope, Miss R. A. Cope, Mrs. E. H. Vaux, Joseph S. Lovering, Jr., Samuel P. Carpenter, Richard R. Robb, William Hacker, Stephen Colwell, Miss Ann Haines, Miss Jane R. Haines, F. L. Bodine, Horace M. Bellows, M. D., John G. Stetler, M. D., William Procter, Jr., and Anthony Heger, M. D., U. S. A.

The election for Standing Committees, deferred from the last business meeting, was held with the following result :

ETHNOLOGY.

J. AITKEN MEIGS,
S. S. HALDEMAN,
F. V. HAYDEN.

BOTANY.

ELIAS DURAND,
AUBREY H. SMITH,
H. C. WOOD, JR.

COMP. ANAT. AND GEN. ZOOLOGY.

JOSEPH LEIDY,
HARRISON ALLEN,
S. B. HOWELL.

MINERALOGY.

WILLIAM S. VAUX,
S. R. ROBERTS,
ALBERT LEEDS.

MAMMALOGY.

J. H. SLACK,
E. D. COPE,
HARRISON ALLEN.

GEOLOGY.

ISAAC LEA,
F. V. HAYDEN,
T. A. CONRAD.

ORNITHOLOGY.

JOHN CASSIN,
SPENCER F. BAIRD,
B. A. HOOPES.

PALÆONTOLOGY.

T. A. CONRAD,
JOSEPH LEIDY,
F. V. HAYDEN.

HERPETOLOGY AND ICHTHYOLOGY.

EDWARD D. COPE,
S. WEIR MITCHELL,
CHARLES SHAEFFER.

PHYSICS.

ROBERT BRIDGES,
ROBERT E. ROGERS,
JACOB ENNIS.

[Feb.

CONCHOLOGY.

GEORGE W. TRYON, JR.,
E. R. BEADLE,
C. F. PARKER.

LIBRARY.

JOSEPH LEIDY,
JOHN CASSIN,
ROBERT BRIDGES.

ENTOMOLOGY AND CRUSTACEA.

JOHN L. LE CONTE,
J. H. B. BLAND,
TRYON REAKIRT.

PROCEEDINGS.

JOSEPH LEIDY,
WILLIAM S. VAUX,
JOHN CASSIN,
ROBERT BRIDGES,
GEORGE W. TRYON, JR.

On favorable report of the respective committees, the following were ordered to be published :

On Colonies of PLANTS observed near Philadelphia.

BY AUBREY H. SMITH.

During the years 1864, 1865 and 1866, a large number of introduced plants, chiefly southern, were found growing on the waste grounds below the Philadelphia Navy Yard, and at Kaighn's Point and Petty's Island, on the opposite shore of the Delaware.

It has been thought by those who were engaged in the work of collection, that some account of these localities and a list of the plants themselves should be placed at the command of students investigating the subject of the introduction and naturalization of plants. To meet this view I have prepared the following pages.

The city of Philadelphia is built on a low gravelly bluff, extending along the right bank of the Delaware with little interruption from Kensington on the north to the Navy Yard on the south. It is scarcely practicable now to define accurately the limits of this bluff, but it may be stated, in general terms, that above Kensington and below the Navy Yard, it recedes from the river, and its place is supplied by tide marshes to a greater or less extent. Northward these marshes have been largely filled up and built upon, but southward the low margin of the river has been but partially reclaimed.

Immediately below the Navy Yard, the rim of tide marsh does not exceed two or three hundred yards in width. Further down the river it widens greatly, and has been banked in for agricultural and grazing purposes. Between the Navy Yard and the banked meadows, the tide flats have awaited the slow demands of commerce for their utilization.

The first step to the reclamation of the flats is the extension of the lines of the eastern streets to the line of low tide, and the building of bulk-heads of logs at their extremities below low water mark. The streets thus extended are filled up with waste earth from cellars and similar excavations, and thus causeways are made out to the bulk-heads. Next, the bulk-heads themselves are extended right and left to meet similar works from the ends of other streets. The wharf line thus built is then conveniently secured by the deposit behind it of sand and gravel ballast from coasting vessels, as well as of earth brought specially for the purpose. Behind it, there will, of course, exist a pond or lagoon, to be filled up from time to time, from the river or from the land, as materials may offer themselves on either side of it.

From Dickerson Street northward to the Navy Yard, the flats have been entirely reclaimed, and coal wharves and ship yards occupy their place. Southward of this street, at the distance of six or seven hundred feet, an earthen embankment extends Morris Street to the line of low water, and a bulk-head 1867.]

carried to the left connects this causeway with the reclaimed land at Dickerson Street. A pond, not now of more than three acres in extent, lies behind the bulk-head, and communicates with the river by a covered sluice, through which the tide ebbs and flows. Between the pond and the river are some two acres of ground made by the deposit there, through many years, of sand and gravel ballast from the coasters, and of mud from the cleansing of the docks of the city. On the west and north the pond is rapidly diminishing in size, as waste materials from the city are cast into it, and in a few years it will no doubt wholly disappear. The marshes formerly existing above Dickerson Street have been reclaimed by the same process, and those below Morris Street will in time be dealt with in a similar manner. Upon the reclaimed land behind the bulk-head between Dickerson and Morris Streets have been found the greater part of the plants enumerated in this list. This locality, which for convenience we have called the Ballast Ground, did not exist fifteen years ago, for the bulk-head which protects it from the river has itself been built within that period. Some of the plants may, however, have existed in similar places along the river for a long time. Muhlenberg, in his catalogue published in 1813, mentions *Senebiera didyma* and *Cynodon Dactylon* as plants of Pennsylvania, though since his day they have only been found, so far as I have learned, at or near this place. *Salicaria Kali* is not rare in the waste grounds about Philadelphia, and *Atriplex hastata*, its maritime congener, is abundant in every neglected out-plot. *Pluchea camphorata* and *Aster linifolius* are firmly established in a pool, at the foot of Tasker Street, not connected with the pond behind the Ballast Ground and probably of much older date and different origin, whilst *Artemisia biennis* is abundant in by-places for half a mile about.

The unenclosed grounds below the Navy Yard are in some respects very favorably situated for the growth of southern plants. The trend of the river shore being south by west, the whole width of the city spreads between them and the quarters from which the colder winds blow. Those of the north and north-west must pass before reaching the Navy Yard for four or five miles over houses and factories, the innumerable fires of which will at all times temper their rigor, whilst the easterly, southerly and south-westerly winds are made yet milder by the wide expanse of water over which they come. The ground too being at the level of tide offers the most favorable conditions, so far as elevation is concerned.

I regret that it has not been in my power to obtain thermometrical observations from which a comparison might be made of the average temperatures, at different seasons, of several points in a line running north-westwardly from the Navy Yard to Girard College. From these we could learn whether or not the causes I have indicated are able to produce sensible effects on the vegetation at the margin of the river. Those at Girard College are all that are needed for that station, but, there being no intermediate ones, they are of no avail for the present purpose.

Nearly opposite the Ballast Ground, on the New Jersey side of the river at Kaighn's Point, is a large enclosed ship and timber yard, which presents conditions somewhat similar to those of the locality just described. A portion of the low ground at this place has been filled in and levelled out to the wharves and bulk-heads, whilst another part of it remains nearly in its natural state. From this enclosure come the most of the plants attributed in this list to Kaighn's Point, though a few of them have been found without its limits.

Petty's Island is a tract of reclaimed alluvion on the New Jersey side of the Delaware, opposite the mouth of Cooper's Creek, which has been, to some extent, used of late years as a place of deposit for ballast, sand and other waste and rough material. It was not known as a botanical locality of interest until visited during the present year (1866) by Mr. Isaac Burk. Since his discovery of it, however, it has been constantly and carefully watched by him and other botanists, and the results of their observations are to be found herein.

Both Kaighn's Point and Petty's Island share the advantages for the growth
[Feb.

and naturalization of the plants of warmer climates which have been ascribed to the Ballast Ground. Sheltered by the wide sweep of the city crescent from the colder winds, they lie at the level of tide with the broad expanse of the river, further to temper the atmosphere which reaches them.

I have been thus minute in the description of these localities, in order not only that the circumstances under which these curious colonies of strangers have taken up their abode with us may be understood, but, in the anticipation of their speedy destruction as the city extends its limits, and of the establishment of similar ones elsewhere on its outskirts, that those who shall observe such future settlements may have the means of tracing their history and development.

The Ballast Ground locality was discovered by Messrs. Diffenbaugh and Parker in the latter part of the season of 1864; that at Kaighn's Point was made known about the same time by the last named gentleman. Since then the plants of those places, and in 1866 those of Petty's Island, have been carefully watched and collected by a number of botanists. Among these I may especially mention Dr. Martindale and Messrs. Burk, Diffenbaugh and Parker, to each of whom I am indebted for some of the rarest in the list.

All the plants have been submitted to Prof. T. C. Porter, and the determinations in all cases of difficulty have his full concurrence. Dr. Porter himself shared the work of collection.

It will be observed in many instances that the fruit has not matured, and in some that not even the flower has appeared. This may not always have been due to the shortness of the season, but sometimes to the late deposit of the sand or gravel with which the seeds have been brought from the south.

A small number of the plants of 1864 did not re-appear in 1865, and some of those of 1865 were not found in 1866. One or two of them, threatened by the frost before flowering or fruiting, were transplanted, and developed their characters under glass. For this service we are indebted to Mr. Kilvington and Dr. Leidy.

Many plants were found growing with those enumerated in the list, which are regarded as introduced, but which are not strictly confined to the localities above described. Some of these are rare and of limited distribution. Nevertheless, but few of them have been included herein, inasmuch as this list is intended, in the main, to contain the names only of those which have not hitherto been collected in the neighborhood of Philadelphia. At a subsequent period, a supplemental catalogue may be given of such of these as shall be deemed of interest.

This list exhibits, as nearly as my information enables me to give it, the actual state of the adventive flora of the several localities in each of the years of collection; but it is proper to say that the time which has elapsed since their discovery has been too short to justify any positive assertion as to the completeness of the catalogue, or the appearance or disappearance of any of the plants named in it.

1. *Erysimum orientale*, *R. Br.* (*Brassica orientalis*, L.) Three specimens collected at Kaighn's Point in 1866. Fruit perfected. Adv. from Europe, where it is widely distributed.

2. *Sinapis alba*, L. A single plant, collected on the waste grounds northwest of the Ballast Ground by Mr. Diffenbaugh, on the 17th June, 1865. Fruit perfected. Adv. from Europe.

3. *Senebiera didyma*, *Pers.* Ballast Ground and Kaighn's Point, Sept. and Oct., 1864, 1865, 1866. Abundant and in mature fruit—rather less common in the latter year. *Hab.*—North Carolina to Florida; Chapman. Also waste places at ports, &c., Virginia to Carolina—an immigrant from farther south; Gray.

1867.]

4. *Senebiera Coronopus*, *Poir.* A single specimen collected on the Ballast Ground by Mr. Burke in 1865. Adv. from Europe.

5. *Cakile Americana*, *Nutt.* Ballast Ground, Sept. and Oct., 1864, 1865. Very few specimens. *Hab.*—Sea coast and Great Lakes; Gray.

6. *Sagina subulata*, *Torr & Gray.* (*S. Elliottii*, Fenzl.; *Spergula subulata*, Swartz).

Ballast Ground, 1865, 1866. Less frequent in the latter year. Fruit perfected in both seasons. These specimens, and others apparently of the same species from Charleston, S. C., are glandular hairy on the peduncles and calyx,—not smooth, as in *S. Elliottii*, according to Chapman.

In the spring of 1865, Mr. Charles E. Smith collected at Somer's Point, N. J., a slender form of *S. subulata*, which Dr. Gray regards as a variety, and has called, from the discoverer, var. *Smithii*. Dr. Gray now considers *S. Elliottii* not distinguishable from *S. subulata*.

7. *Sesuvium Portulacastrum*, *L.* Two small patches near the southern end of the Ballast Ground, 1865. Fruit matured. *Hab.*—Sea coast of New Jersey and Southward; Gray.

8. *Sesuvium pentandrum*, *Ell.* Petty's Island, 1866. Not frequent; fruit perfected. *Hab.*—Sea coast, North Carolina to Florida; Chapman.

9. *Portulaca pilosa*, *L.* Petty's Island, 1866. Infrequent and with fruit not fully developed. *Hab.*—Key West, Florida; Chapman.

10. *Malvastrum tricuspidatum*, *Gray.* Pl. Wright, Pt. I., p. 16. (*M. carpinifolium*, *Gray.* Pl. Fendl., p. 22.) Two specimens with imperfect fruit collected by Mr. Burk and Diffenbaugh, on the Ballast Ground, in 1865. Dr. Porter has two specimens from the same locality with perfected fruit. This plant is probably the *Malva Americana* of Muhlenberg's Catalogue, p. 62, where it is recorded as growing in Pennsylvania. *Hab.*—South Florida; Chapman.

11. *Sida stipulata*, *Cav.* A considerable number of plants scattered over the Ballast Ground, Sept. and Oct., 1864, 1865. In flower and with fruit nearly perfected. *Hab.*—Waste places about dwellings—Florida. According to DC., this plant has naturalized itself in many parts of the world.

12. *Modiola multifida*, *Moench.* Appeared in leaf only on the Ballast Ground late in the autumn of 1865. It was transplanted by Mr. Kilvington, and, placed under glass, produced its flowers and fruit in April, 1866. *Hab.*—North Carolina to Florida; Chapman.

13. *Kosteletzkya Virginica*, *Presl.* A few specimens collected on the eastern margin of the pond, but none with mature fruit. Sept. and Oct., 1865. Also at Kaighn's Point in the same year. *Hab.*—Marshes along the sea coast, from Long Island southward; Gray.

14. *Gossypium herbaceum*, *L.* Eastern and western margins of the pond. Oct., 1865, 1866. Flowers in both seasons, but no fruit.

15. *Trifolium Carolinianum*, *Mx.* Ballast Ground, 1865. Abundant and with perfect fruit. Less frequent in 1866. Two specimens at Kaighn's Point in the latter year. *Hab.*—North Carolina to Florida; Chapman.

16. *Mellilotus parviflora*, *Desf.* (*M. occidentalis*, *Nutt.*) Ballast Ground and Kaighn's Point, 1865, 1866. Abundant and with mature fruit in both seasons. Adv. from Europe into Western Texas and Mexico. (U. S. Boundary Survey, Emory, Vol. II., p. 55.)

17. *Medicago maculata*, *Willd.* Ballast Ground, collected Oct. 14, 1866. Two specimens without flower or fruit. Adv. from Europe.

[Feb.

18. *Medicago denticulata*, Willd. Ballast Ground, 1865, 1866. Rare, fruit perfected, more frequent in the latter year. Adv. from Europe.

19. *Glottidium Floridanum*, DC. A single plant collected on the Ballast Ground, but more frequent at Kaighn's Point. Sept. and Oct., 1865. One specimen at Petty's Island, Sept., 1866. Fruit not matured in any case. *Hab.*—South Carolina to Florida; Chapman.

20. *Sesbania macrocarpa*, Muhl. Ballast Ground, Sept. and Oct., 1865. Many specimens in full flower, but without perfect fruit. This plant and *Glottidium Floridanum* flowered about the 1st October, and were killed by the frost before their fruit was matured. *Hab.*—South Carolina to Florida; Chapman.

21. *Ervum Lens*, L. Federal Street wharf, Camden. Collected by Mr. Diffenbaugh, August 6th, 1865. Rare. Adv. from Europe.

22. *Vigna glabra*, Savi. Ballast Ground and Kaighn's Point, Sept. and Oct., 1865, 1866. Abundant in both places, but not perfecting its fruit. *Hab.*—Brackish marshes, from Florida to South Carolina; Chapman.

23. *Cassia obtusifolia*, L. Ballast Ground and Kaighn's Point, Sept. and Oct., 1865, 1866. A few flowering plants, but the fruit not matured. *Hab.*—North Carolina to Florida; Chapman.

24. *Potentilla argentea*, L. Collected at Kaighn's Point by Mr. Parker, June 4, 1865, with ripe fruit. Also at the Ballast Ground in 1865 and 1866. This plant has been observed in previous years near Red Bank, N. J. *Hab.*—Dry barren fields northward; Gray.

25. *Potentilla anserina*, L. Ballast Ground, 1865. A single specimen collected in flower by Mr. Diffenbaugh. *Hab.*—Brackish marshes and river banks, chiefly northward; Gray.

26. *Ammania latifolia*, L. Two specimens collected near the eastern margin of the pond by Mr. Diffenbaugh, Sept. 8, 1865. Fruit not matured. Two from the same place by Mr. Burk in 1866, with perfect fruit. It was also collected by Mr. Parker at Kaighn's Point, in 1866, in good fruit. *Hab.*—Ohio, Illinois, and southward; Gray.

27. *Oenothera sinuata*, L., var. *humifusa*, Torr. and Gray. Sparingly distributed on the Ballast Ground, Sept., 1866. *Hab.*—Drifting sands along the coast; Chapman.

28. *Gaura sinuata*, Nutt.? Collected on the Ballast Ground by Mr. Parker, Sept. 30, 1864. Fruit scarcely matured.

29. *Jussiaea repens*, L. Along the margin of the pond in several places; also at Kaighn's Point, 1864, 1865. In flower and with matured fruit. Kaighn's Point, 1866. Fruit perfected. Also at Petty's Island, 1866, but rare. Fruit perfected. *Hab.*—In water, Illinois, Kentucky and southward; Gray.

30. *Jussiaea leptocarpa*, Nutt. Along the margin of the pond, 1865. Several specimens, but the fruit not matured. *Hab.*—In marshes, Florida, and westward; Chapman.

31. *Jussiaea decurrens*, DC. Ballast Ground, 1865. Rare. *Hab.*—Ditches, Florida to North Carolina, and westward; Chapman.

32. *Leptocaulis divaricatus*, DC. Ballast Ground, 1865. Several specimens with perfected fruit. Kaighn's Point, 1866. Two specimens. *Hab.*—Sandy soil, North Carolina to Florida; Chapman.

33. *Asperula arvensis*, L. Ballast Ground, 1866. A single plant collected in flower, by Mr. Burk. Adv. from Europe.

1867.]

34. *Galium tricornae*, *Host.* Ballast Ground, 1866. Collected by Mr. Burk. Larger than the European form. Adv. from Europe.

35. *Diodia Virginica*, *L.* Ballast Ground, 1865. Abundant and in perfect fruit. *Hab.*—Virginia and southward; Gray.

36. *Oldenlandia glomerata*, *Mz.* A single specimen from the Ballast Ground, but more frequent at Kaighn's Point. *Hab.*—Western Pennsylvania to Illinois, and southward; Gray.

37. *Polypremum procumbens*, *L.* Ballast Ground, Sept. and Oct., 1864 and 1865. Kaighn's Point, 1865, 1866. Abundant, fruit perfected. *Hab.*—Sandy fields, Virginia and southward; Chapman.

38. *Eupatorium fœniculaceum*, *Willd.* Growing freely on both sides of the river, Sept. and Oct., 1864, 1865. Scarcely so abundant in 1866. Fruit not matured in either season. *Hab.*—Virginia, near the coast and southward; Gray.

39. *Eupatorium serotinum*, *Mz.* At the eastern edge of the pond, Sept. 30, 1865. Fruit not matured. Also at Petty's Island, Sept., 1866, in flower only. *Hab.*—Illinois and southward; Gray.

40. *Aster linifolius*, *L.* At the foot of Tasker Street, in a pool west of and not connected with the main pond. Abundant and in perfect fruit., Oct., 1864, 1865, 1866. *Hab.*—Salt marshes, Maine to Virginia; Gray.

41. *Solidago sempervirens*, *L.* Eastern margin of the pond, Oct., 1865. More abundant in 1866 at the same place. Fruit matured in both years. *Hab.*—Salt marshes, Maine to Virginia; Gray.

42. *Heterotheca scabra*, *DC.* Abundant on both sides of the river in Sept. and Oct., 1864, 1865, and 1866. Fruit matured. Rather less plentiful in 1866 than in the former years. *Hab.*—Sandy places along the coast of South Carolina and westward; Chapman.

43. *Pluchea camphorata*, *DC.* In the pool at the foot of Tasker Street, and at Kaighn's Point, Sept. and Oct., 1864, 1865, 1866. Also along the eastern margin of the main pond in the latter year. Abundant and in perfect flower and fruit. *Hab.*—Salt marshes, Massachusetts and southward; Gray.

44. *Pluchea fœtida*, *DC.* Kaighn's Point, 1865. Collected by Mr. Parker, in flower only, on the 21st Sept. *Hab.*—Ohio to Illinois, and southward; Gray. Florida and northward; Chapman.

45. *Iva frutescens*, *L.* Several specimens, collected in leaf along the western margin of the pond, Sept. and Oct., 1865. *Hab.*—Sea coast, Mass., and southward; Gray.

46. *Parthenium hysterophorus*, *L.* Ballast Ground, Sept., 1864. Two specimens collected by Messrs. Parker & Dittenbaugh, in flower and young fruit. Kaighn's Point, 1866,—a single plant. *Hab.*—East and South Florida; Chapman.

47. *Helenium quadridentatum*, *Labill.* Ballast Ground, Oct., 1864. Rare. In flower and young fruit. Rather plentiful at Petty's Island in 1866. *Hab.*—North Carolina and westward; Gray.

48. *Centaurea calcitrapa*, *L.* Kaighn's Point, 1865. Scarce. *Hab.*—Norfolk, Va.; Gray. Adv. from Europe.

49. *Artemisia biennis*, *Willd.* Abundant in waste places, for half a mile, about the Navy Yard, 1864, 1865, 1866. Also at Petty's Island in the latter

[Feb.

year, but not so plentiful. This plant, in full growth, is very much branched. *Hab.*—River banks, Ohio to Illinois, and northward; Gray.

50. *Leontodon autumnale*, *L.* Kaighn's Point, August, 1865, 1866. Petty's Island in the latter year. Rare. Fruit perfected. Nat. from Europe.

51. *Pyrrhopappus Carolinianus*, *DC.* Ballast Ground, 1864, 1865. Scarce. Kaighn's Point, 1866,—a single specimen only. *Hab.*—Sandy fields, from Maryland, southward; Gray.

62. *Plantago heterophylla*, *Nutt.* Ballast Ground and Kaighn's Point, 1865, 1866. Abundant in 1865. Less frequent in the latter year. Fruit perfected. *Hab.*—Maryland and Southward; Gray.

53. *Anagallis arvensis*, *L.*, var. *cœrulea*. Ballast Ground, 1866. A single specimen collected by Mr. Burk. Nat. from Europe.

54. *Collinsia parviflora*, *Dougl.* Ballast Ground, 1865. A single specimen collected in fruit by Mr. Burk. *Hab.*—South shore of Lake Superior, and thence westward; Gray.

55. *Herpestis Monniera*, *H. B. K.* Petty's Island. Collected by Mr. Burk in flower and mature fruit, on the 21st October, 1866. *Hab.*—Maryland and southward along the coast; Gray.

56. *Conoclea multifida*, *Benth.* Ballast Ground and Kaighn's Point, Oct., 1865. Also at Petty's Island, 1866. Rare and in perfect fruit. *Hab.*—Ohio to Illinois, and southward; Gray.

57. *Gerardia purpurea*, *L.*, var. *fasciculata*, *Ell.* Ballast Ground, 1864, Oct., 1866. In flower and fruit. *Hab.*—Sea coast, South Carolina to Florida; Chapman.

58. *Verbena bracteosa*, *Mx.* Kaighn's Point, 1866. In flower only. Scarce. *Hab.*—River banks, Wisconsin to Kentucky, Gray.

59. *Calamintha nepeta*, *Link.* Ballast Ground, 1864. Two specimens collected in flower by Mr. Parker. Nat. from Europe, in Virginia and southward.

60. *Heliotropium Europæum*, *L.* Ballast Ground, 1864, 1865. A single specimen collected by Mr. Parker in 1864. In 1865 several additional ones in flower only. Maryland, Virginia, &c.; Gray. Nat. from Europe.

61. *Heliotropium Curassavicum*, *L.* Ballast Ground, 1865. A single plant growing in calcareous sand. Abundant and in full fruit at Petty's Island in 1866. *Hab.*—South Florida; Chapman.

62. *Nama Jamaicensis*, *L.* Ballast Ground, 1865. A single specimen in fruit. *Hab.*—South Florida; Chapman.

63. *Batatas littoralis*, *Chois.* Ballast Ground, Oct. 9, 1865. Several plants in early flower, but without fruit. Also in 1866, but without flowers. *Hab.*—Sea coast, Florida to South Carolina; Chapman.

64. *Ipomea tamnifolia*, *L.* Ballast Ground, Sept. 7, 1865. A single specimen collected in flower by Mr. Burk. *Hab.*—South Carolina to Florida; Chapman.

65. *Dichondra repens*, *Forst.*, var. *Carolinensis*, *Chois.* Petty's Island. Collected by Mr. Diffenbaugh, Oct. 21, 1866, without flower or fruit. Not frequent. *Hab.*—North Carolina to Florida; Chapman.

66. *Petunia parviflora*, *Juss.* (Ann. Mus. 2, p. 216, t. 47.) Ballast Ground, Sept., 1864, 1865. Rather frequent. Also in 1866, but very scarce. Abundant at Petty's Island in the latter year. *Hab.*—Lower Rio Grande and 1867.]

Mexican States, westward to California. (U. S. Boundary Survey, Emory, Vol. ii., Part i., p. 155.)

67. *Roubieva multifida*, *Moguin*. Ballast Ground, 1865. Sparingly distributed throughout the central portion of the ground. Fruit matured. Adv. from tropical America.

68. *Obione arenaria*, *Moguin*. Ballast Ground, 1865. A few specimens with ripe fruit. Also in 1866 but scarce. *Hab.*—Sea coast, from Massachusetts Southward; Gray.

69. *Chenopodia maritima*, *Moguin*. Ballast Ground, 1864—1865. Not frequent. Fruit perfected. *Hab.*—Salt marshes along the coast; Gray.

70. *Euxolus pumilus*, *Raf.* Ballast Ground, 1865. A single specimen collected in flower by Mr. Diffenbaugh. *Hab.*—Sea coast from Long Island Southward; Gray.

71. *Polygonum minus*, *Hudson*. Ballast Ground, 1866. Collected by Mr. Burk. Scarce. Adv. from Europe.

72. *Euphorbia polygonifolia*, *L.* Ballast Ground. Rare and not in flower in 1865. In 1866 a single specimen in perfect fruit. Also at Petty's Island in 1866, one plant. *Hab.*—Shores of the Atlantic and Great Lakes; Gray.

73. *Euphorbia herniarioides*, *Nutt.* Ballast Ground, 1865. In fruit. Petty's Island, Oct. 21, 1866, in fruit. Frequent. *Hab.*—Banks of the Ohio and Mississippi Rivers; Gray.

74. *Euphorbia Helioscopia*, *L.* Ballast Ground, 1864. A single specimen. Found elsewhere in Pennsylvania, though rare. Nat. from Europe.

75. *Euphorbia exigua*, *L.* Kaighn's Point, 1866. Collected by Mr. Burk in fruit. Scarce. Adv. from Europe.

76. *Acalypha gracilens*, *Gray.* Ballast Ground and Kaighn's Point, 1865—1866. Rare in both years. Common southward.

77. *Croton glandulosum*, *L.* Ballast Ground, 1864, 1865, 1866. Frequent and in ripe fruit. More abundant in the last of these years. *Hab.*—Virginia, Illinois and southward; Gray.

78. *Croton maritimum*, *Walt.* Ballast Ground, 1865. Leaves only. *Hab.*—Drifting sands along the coast from North Carolina to Florida; Chapman.

79. *Phyllanthus polygonoides*, *Nutt.* Ballast Ground. A single specimen collected by Mr. Diffenbaugh, Oct. 1, 1865. Fruit scarcely perfected. *Hab.*—Along the Rio Grande and westward in Mexico, (Boundary Survey, Emory, Vol. II, p. 193.)

80. *Juncus articulatus*, *L.*, var. *obtusior*, *Engelm.* Kaighn's Point and Petty's Island, 1866. Not abundant. *J. articulatus* has hitherto been found in the United States only in New England and Western New York.

81. *Juncus nodosus*, *L.*, var. *megacephalus*, *Tor.* Ballast Ground and Petty's Island, 1866. Not abundant. A northern plant not before found in the vicinity of Philadelphia.

82. *Juncus bufonius*, *L.*, var. *fasciculiflorus*, *Boiss.* Ballast Ground, 1865. Frequent. Dr. Engelmann states this to be a southern form widely diffused in intertropical regions.

83. *Juncus Gerardi*, *Loisel.* Petty's Island, 1866. Not frequent. *Hab.*—Sea coast from New Jersey northward; Gray.

[Feb.

84. *Cyperus fuscus*, *L.* Kaighn's Point, 1865. In mature fruit. Adv. from Europe.

85. *Cyperus Nuttallii*, *Torr.* Ballast Ground, Sept. and Oct., 1865, 1866. Abundant in 1865, less so in 1866. Also at Petty's Island in 1866, but not very frequent. Fruit matured in every case. *Hab.*—Salt marshes from Massachusetts southward; Gray.

86. *Cyperus Michauxianus*, *Schultes.* Ballast Ground, 1864, 1865. Frequent along the margins of the pond. Fruit perfected. Less common in 1866. Marshes especially along the coast, from New England southward; Gray.

87. *Cyperus rotundus*, *L.*, var. *Hydra*, *Gray.* Ballast Ground and Kaighn's Point, Sept. and Oct., 1865, 1866. Abundant in both places in 1865; less frequent in 1866. Fruit matured, though most of the scales were empty. *Hab.*—Sandy soils along the coast from North Carolina to Florida; Chapman.

88. *Cyperus compressus*, *L.* Ballast Ground and Kaighn's Point, 1864, 1865, 1866. Frequent but least common in the latter year. Abundant at Petty's Island in 1866. Fruit perfected in each season. Found also in Maryland by Mr. Canby. *Hab.*—Florida to North Carolina and westward; Chapman.

89. *Cyperus Baldwinii*, *Torr.* Ballast Ground, 1864, 1865. Frequent in the sandy ground near the bulk-head, fruit perfected. *Hab.*—Florida to North Carolina and westward, Chapman.

90. *Hemicarpha subsquarrosa*, *Nees.* Petty's Island, Oct. 21, 1866. Scarce. Fruiting perfectly. Not before found near Philadelphia.

91. *Lipocarpa maculata*, *Torr.* Petty's Island, Oct. 21, 1866. Scarce. Fruit perfected. *Hab.*—North Carolina to Florida; Chapman.

92. *Fimbristylis spadicea*, *Vahl.* Ballast Ground, 1865. Scarce, fruit perfected. *Hab.*—Salt marshes along the coast from New York southward; Gray.

93. *Fimbristylis congesta*, *Torr.* Ballast Ground and Kaighn's Point, 1865. Not scarce. In 1866 less common. Also at Petty's Island in 1866 but not frequent. *Hab.*—Florida and Westward; Chapman.

94. *Fuirena squarrosa*, *Mx.* Petty's Island, Oct., 1866. Scarce, fruit not matured. (Kaighn's Point in 1818. Barton in Flor. Phil. p. 37.) *Hab.*—Massachusetts and southward; Gray.

95. *Alopecurus geniculatus*, *L.* Ballast Ground. Collected by Dr. Martindale in 1865. Not before found in Pennsylvania.

96. *Sporobolus Indicus*, *Brown.* Ballast Ground and Kaighn's Point, 1865. Petty's Island, 1866. Not scarce, fruit perfected. The specimens from Petty's Island are prostrate, as in many maritime plants. *Hab.*—North Carolina to Florida; Chapman.

97. *Spartina juncea*, *Willd.* Ballast Ground, 1865, 1866. Sparingly distributed along the margin of the pond. Less frequent in the latter year. *Hab.*—Salt marshes and sea coast; Gray.

98. *Eustachys petraea*, *Desv.* Ballast Ground, 1865. Leaves and imperfect fruit; developed under glass by Dr. Leidy, it produced perfect fruit in 1866. *Hab.*—North Carolina to Florida along the coast; Chapman.

99. *Cynodon Dactylon*, *Pers.* Fully naturalized and abundant throughout the waste grounds below the Navy Yard. Also at Kaighn's Point, 1864, 1865, 1866. This plant was found at New Castle, Del., by Mr. C. E. Smith, in 1864. A second form of it, nearly smooth and more robust, having pointed
1867.]

paleæ and the flowering culms included in their sheaths, grows sparingly along the margins of the pond and elsewhere in the vicinity in damp places. Mr. Burk has observed this second form for twelve or fifteen years past on the hard dry surface of the Point Road below the old Southwark Canal. He states it to have been more abundant in 1866 than ever before. *Hab.*—Pennsylvania and southward; Gray. Nat. from Europe.

100. *Dactyloctenium Ægyptiacum*, Willd. Ballast Ground and Kaighn's Point, 1864, 1865, 1866. Common in both localities. Rather less frequent in 1866 than before. *Hab.*—Virginia, Illinois and southward; Gray.

101. *Leptochloa mucronata*, Kunth. Kaighn's Point, 1865. Not frequent. *Hab.*—Virginia to Illinois and southward; Gray.

102. *Leptochloa fascicularis*, Gray. Kaighn's Point, 1866. Collected by Mr. Burk. Scarce. *Hab.*—Rhode Island and Southward along the coast; Gray.

103. *Glyceria distans*, Wahl. Spreading over the vacant lots west of the Ballast Ground. Abundant. *Hab.*—Salt marshes along the coast; Gray.

104. *Brizopyrum spicatum*, Hook. Ballast Ground, 1865, 1866. Staminate plants only. *Hab.*—Salt marshes; Gray.

105. *Paspalum distichum*, L. Ballast Ground, 1864, 1865, 1866. Along the wet margin of the pond, in similar places at Kaighn's Point, and in 1866 at Petty's Island. Abundant and with mature fruit. *Hab.*—Virginia and southward; Gray.

106. *Panicum amarum*, Ell. Ballast Ground, 1865. Two flowering specimens. Again in 1866, but only one or two plants not in flower. *Hab.*—Sandy shores, Connecticut and southward; Gray.

The Cutting Ant of Texas—*OECODOMA TEXANA*, Buckley.

BY GIDEON LINCECUM.

In many portions of Texas this species of ant is quite numerous and troublesome. It is capable of and actually does perpetrate more real perplexing injury to the horticulturist and farmer, than all the other types of Texan ants put together. In form and color the larger varieties of them do not differ in appearance very much from the agricultural ants. A great portion of our citizens speak of these two ants without distinction, as being the same species. There is, however, a well-marked difference in their community regulations; in their manners and customs, in their mode of constructing their cities, in their peculiar food and manner of preparing it, and in their civil and military governments.

There are five varieties or castes in this species, all of which may be seen in the same community, or city as I prefer to call it. They vary in size from that of a drone honey bee down to near that of the little black erratic ant; and their duties and vocations are as variant as their sizes. The largest size have wings and are the mother ants. They dwell in the ground in sandy lands, and one of their long established cities will, on an average, occupy at least two square rods of surface. The area of the city is considerably elevated; often one to two feet, and sometimes even more. The earth which is thus thrown up, and which is universally sand, is thrown out from their numerous and capacious cells below, and from their extensive tunnels or subterranean passages. To their cells they have many holes, or places of entrance, and some of them are tunnelled off several hundred yards.

It is known to many observant Texans that in all the larger cities the ants

[Feb.

have penetrated the earth to water. This accords with my not very limited experience on the subject. I know of a number of wells which were intentionally sunk in the cutting ant hills to procure water, and I have been informed by the owners of these wells, that ant cells, tunnels and live ants were found all the way down to the water. I have myself seen and drank water out of eight of these wells, and have accounts of many others. I have not heard of a failure in any attempt for obtaining water by digging in a cutting ant hill.

Mr. G. W. Brooks states that, in Chappel Hill, Washington County, Texas, Columbus Pearson dug a well in an ant hill and obtained plenty of water at the depth of thirty feet. The facts in this case worthy of notice, and for which it is here recorded, is the manner in which the ants had also sunk two wells to the water. These ant wells were large and well-formed, one of them being fully twelve inches in diameter, the other six inches, both going straight down to the water. The walls of these wells were travel-worn and stained of a dirty brown color, presenting the appearance of having been in use for years. Mr. Pearson states that, if these ant wells had been opened properly, a bucket could have been let down the largest one at the outset.

Dr. Fechtig, of Brenham, informed me that he had been making observations on the cutting ant for some months; and some of his discoveries, which he was kind enough to communicate to me, are valuable and of an interesting character, particularly as they afford additional testimony in favor of observations I have made in reference to the disposition of the dirt which comes out of their tunnels, &c. These passages are always commenced within the compass of the city mound; the sand that is taken from the tunnels is always thrown back on the mound. These tunnels are made at the depth of eight to twelve inches, and in the direction of the object for which they are excavated. Sometimes, as I will show presently, on extraordinary occasions they are carried at a much greater depth. Dr. Fechtig's case, which I will now relate, was a tunnel from one of their cities to a neighboring well; the tunnel entering the well ten or twelve feet below the surface of the ground. The well being walled with oak timbers, the ants had cut their way through to gain access to the water. In performing the boring through the thick oaken curbing, they threw down into the well so much saw-dust that the people were forced to strain the water previous to using it. On examination Dr. Fechtig found that a quantity of oak chips, similar to those which had been separated from the well water, had also been thrown out on the ant mound.

Situated in a garden at Austin, Texas, there was a large, very populous and seemingly prosperous cutting ant city. The ants had for years, in spite of many patent traps and newly discovered ant poisons, damaged the garden extensively. The proprietor of the garden at last conceived the idea that he would try to drown them, and for this purpose dug a large basin-formed pit in the ant mound, and led trenches into it right and left from the hillside above the ant city, to convey the water into the basin when it should rain. Not long after this preparation was completed, there came a tremendous rain storm. Large quantities of water rushed along the ditches into the basin dug in the mound. To the gentleman's surprise the basin did not fill, but seemed to send forth hollow sounds. After the rain was over it was found that all the water which had been conveyed into the basin had been swallowed up. There is a creek with a flat rock bottom about seventy yards from the ant hill, and it was discovered that the water from the trenches had rushed down the wells of the ant city, washing out, down to the rock, (22 feet), an immense hole, thence along a great tunnel on top of the rock, to the before named creek, where the entire sluice, charged with millions of ants and sand and mud, made its escape into the creek.

Under a beautiful wide spreading live-oak (*Q. Virens*) on the west border of the town of La Grange, Texas, there was an extensive and flourishing ant city. The city mound was large, occupying the entire area overshadowed by the 1867.]

live-oak. Nearly on a level and not exceeding eighty yards from the ant hill, there was a considerable pond of filthy water, which, being in the street, the town authorities ordered it drained. A ditch was opened along one side of the street which intersected the ant mound near its center, and for the purpose of inundating and drowning the ants, the workmen let the water into the ditch, and when it reached the mound (which had been ditched through to its further side) it found many open passages, down which it flowed quite freely. It was near night when the workmen left it, with the water passing into and seeming to be rapidly enlarging the hole it had already opened in the mound.

The workmen and a number of the town people visited the place next morning. The pond was dry, and the ant mound had also disappeared; and what was more wonderful still, the large live-oak had settled down into the chasm that had been made by the disappearance of the ant mound, until the lower limbs of the tree were resting on the brink of it. (The lower limbs of a prairie live-oak are seldom more than six or seven feet above ground.) The outer ends of the very numerous live-oak roots were still clinging by their long ramifications in the walls of the great pit all around, and the large tree was swinging securely upon this net-work of roots as upon a hammock. But where did the water, mound and ants all go to? was the question among the La Grange folks. The Colorado river passes in its deep channel three hundred yards distant from the ant hill, and the popular supposition was, that the mound, ants and all, had passed through their great tunnel, which they had previously excavated, into the river. Several years have gone by, and still when it rains the pond vents itself through that ant chasm, and the live-oak, though still green and thrifty, has settled deeper in the ground. I know of many other wells and tunnels that were made by the cutting ants, but as I have recorded a sufficient number of them here to establish these great works as a characteristic trait in their national action, it is deemed unnecessary to add any more.

All the sand and other material that is seen piled on the ant mound comes from the wells, tunnels and cells which are excavated for the accommodation of the ants. The work required to throw up these quite conspicuous mounds must have consumed many years, as well as an immense amount of labor. All the sand-carrying labor is performed by the smaller sizes of ants, principally by the very smallest. These are of a dingy brown color, and when crowded have a woolly appearance. These little fellows are lazy and extremely slow in their motion; seeming to perform their daily work with great reluctance. They are often found crowding in each others way about the gates of the city, and do not seem to feel any interest in what they are doing, which is to carry sand day by day. For their size they carry large loads, but they lose the advantage of the big loads by their slow motions. The larger types of this species, which move with greater celerity, pay no attention to the sand carriers, but pass out and in, walking over them and their big loads of sand as if they were the pavement. While I observe the slow, careless action of these lazy little mound builders, I cannot avoid the conclusion that they are slaves.

As the cutting ants perform their destructive works mostly during the night, I have not made sufficient observation on their nocturnal action to state certainly that they employ their slaves in the leaf-cutting business at all. They have large mandibles and sharp teeth, and I think it likely that they are capable and, perhaps, do participate in the labors and duties of all the departments in the national works. The cutting ants subsist entirely on the leaves of vegetables. They will eat the leaves of various trees, shrubs and some herbaceous plants. I have not observed them eating of any of the grasses. Sometimes during warm spells in winter when, as I suppose, their provision stores have run short, I have seen them cutting and carrying home the buds of the long moss (*Tillandsia usneoides*.) I think, however, that this alternative is resorted to only in periods of great scarcity; as I have never observed them collecting the moss during summer, or at any other time while the season of green foliage continues. They seem to have a regular and well disciplined corps of foragers,

[Feb.

and these, after a suitable tree has been selected by their scouts for them to work at, go forth about twilight and, ascending the designated tree, frequently the tallest willow-oak, (*Q. phellos*) commence the work of destruction. They cut the green leaves into pieces not much less than a five cent piece, and seizing it near one corner with their capacious mandibles elevate it, and tilting it backwards over the crown of the head, it falls edgewise between two strong spines, or horns, which stand erect at the back part of the forehead. Having their load thus adjusted, which, to the observer, seems to stand on its edge on top of the head and lengthways with the body, they hasten away to the appointed place of deposit. It is quite an interesting sight to observe with what precision and celerity they can edge their piece of leaf along amongst hundreds of their fellow laborers who are all carrying similar burthens, while they are meeting on the path an equal number of workers who are hurrying back to the tree empty.

They deposit the leaves on the ground at the place appointed for curing them, where they are left to dry in the sun through the succeeding day. Sometimes the new cut leaves are deposited near the entrance to the city; at other times they are strewn thickly along the path from the tree to the city; and not unfrequently they are thrown down in a pile near the root of the tree from whence they were taken. In either case they are left exposed all day in the sunshine; and they are, during the succeeding night, carefully gathered up and taken into the city; this rule obtains in autumn; they do not cure their leaves until towards winter. All summer time they are carried directly from the tree into the city. Whilst the dried leaves are being stored away, the foragers are engaged in cutting and laying out a quantity of fresh leaves, which undergo the same processes of curing and storing as the previous lot; and so on through the season for storing up food for winter. But should a shower of rain fall upon and wet the laid out leaves while they are out drying, it renders them unfit for food, and they are not stored. I have noticed many piles of these spoiled leaves rotting on the ground that had been damaged by being caught in the rain.

In my observations on the habits of the cutting ants, I have not discovered them eating anything besides the foliage of various plants. Neither have I ever noticed them carrying anything else into their cities. Prof. S. B. Buckley, who is a very close and accurate observer, states that he saw them carrying hackberries (*Celtis occidentalis*) and that they eat insects, tumble bugs, &c. The hackberry has a sweet pulpy covering, and I think it likely that if one of the leaf-eating ants was to find a hackberry, it would try to carry it home; but it being a perfect globe, a little too large for the span of its mandibles, I see not how it could effect it. As to their feeding on insects, I shall not pretend to deny it, for these wonderful, cunning and very sagacious ants doubtless perform many habitual actions that have passed unnoticed in my eighteen years observation.

It is stated that this species of ant does not lay up stores of provisions for winter supplies. I have not opened one of their cities during winter, and therefore cannot assert that they do. But from the immense quantities of leaves collected by them during the autumnal months, which are carefully sun dried and taken into the city, I should feel at a loss to say, if it is not intended for winter food, what other use they can put such quantities of leaves to; and furthermore, when it is known to be the kind of food upon which they subsist. It is also known that they construct cells from fifteen to twenty-five feet below the surface—below the line of change of temperature,—and in these deep subterranean apartments for their winter quarters, they would not become torpid, but would remain active. Now, if during the warm season it is necessary for them to consume the almost incredible amount of leaves which we see them daily carrying in, it becomes a matter of surprise—an unaccountable thing indeed—how they can make out through the winter months without anything to eat, when we know that they are not in a torpid state but lively and active.

1867.]

In this vicinity within the last two years, (1861) the cutting-ants have greatly diminished. Many large cities have dwindled away to a few thinly populated holes; whilst many others are entirely depopulated. This, I think, is mainly attributable to the protracted dry weather. With many other species, particularly the agricultural and little black ants, long drouths seems to favor their increase. Not so with the cutting ant. They evidently decline. A seven years drouth would cause their wells to dry up as it did many of the wells belonging to the *genus homo*. I know of several very pretty homes that were evacuated the present year by human families, on account of the failure of their wells. Their wells dried up, and as they could not deepen them sufficiently to obtain a supply of water, they were obliged to leave their long cherished and well-fixed homes. The ants have done the same thing, and as I think for the same reason. Their wells also failed and they have perished for want of water, or have emigrated to districts more congenial to their peculiar mode of life. Anyhow, they have greatly diminished, and many large cities are actually depopulated and lying in ruins.

On the first of August, 1861, I discovered in a grove of thick timber and much undergrowth, a great many cutting-ant holes. They were all around in the bushes, extending perhaps over an acre of ground. They were all alike of recent date; their newly thrown up little heaps of fresh sand was what first attracted my attention. Finding them there on the hill-side, and actually boring holes in the thick woods, was a performance so entirely contrary to their customary habits, that I was led to the examination of the matter, and if possible to ascertain the cause of this strange unantlike proceeding. My first impression was, there being a large and very ancient city a few hundred yards distant from the new settlement, that it was the work of the recently thrown off queens from that old kingdom; that the young queens had stopped short in the shady woods in consequence of the hot dry weather, and were setting up for themselves in a new style, it being on a declivity and in a densely shaded woodland. I however excused them for all these flagrant deviations from their long established customs, by laying it to the continuous drouth and hot weather. I did not leave them until I had marked the place that I might visit them again, and find out how such a multiplicity of new settlements in so small a track of country would manage in the future. I then paid a visit to the large old ant city spoken of above. I had many times within the preceding twelve years, visited and made observations on its extraordinary public works. When I came there I was astonished to find that its inhabitants were all gone. I found only the large old mound of sand, now smoothed down by time's sweeping winds and the passing cattle, but there were no inhabitants—all had disappeared. They had evidently emigrated to the new settlements I had encountered down the hillside in the thick shady forest, and the inhabitants thereof were not, as I at first surmised, the newly commenced communities of the young queens, but emigrating parties who had gone out from the old city in search of water. Their wells having failed, they could no longer remain in the city, and having left it, had proceeded lower down the hill, and hoping to find water, were sinking many new wells. Subsequent observations have confirmed me in this opinion. The new settlements in a short time were evacuated. Having been unsuccessful in obtaining water at the new place, the ants had either died out or gone to some other district.

In accordance with my observations on this subject, I am forced to the conclusion that the drouth continued too long for them; that in districts where the wells are liable to dry up they often perish. I find that the kingdoms that are located near a constant stream, are in a flourishing state, and have continued so through all the time of the protracted dry season.

The cutting-ants plant seeds of various trees, vines and other plants. When they locate a city in bald prairie, which is often the case, where they cannot procure the seeds of trees, they cultivate the prickly poppy (*Argemone Mexicana*,) the most appropriate plant for their purpose that grows on the prairie.

[Feb.

The seeds of this poppy are planted over the greater portion of the crown of the city mound; the plant springs up during the autumnal rains, forms strong roots in the course of the winter, and by the time the sun becomes oppressively hot the next spring, it has grown up two or three feet high, with umbrageous green foliage and many large white flowers, and affords ample shade to the city.

When the ants locate a city on some sunny point near the timbered lands, they do not plant the poppy, but appear to prefer certain trees and vines for shade. For this purpose they plant the seeds of the prairie dogwood, (*Viburnum dentatum*), Yopon, (*Ilex vomitoria*), Hackberry tree, (*Celtis occidentalis*), Gum elastic tree, (*Bumelia lycioides*), the mustang grape, (*Vitis Texana*), *Cocculus carolinus*, and occasionally the prickly ash (*Xanthoxylum fraxinum*.)

It is often seen in cases of long established cities, that grape vines spread themselves over the tops of the grown up shade trees, and the large luxuriant foliage becomes so dense that it forms a shelter sufficient to turn a smart shower of rain. From the scorching rays of the sun these thrifty vines afford thorough protection.

Notwithstanding the notable fact that all the plants these ants cultivate, produce nuts, pulpy fruits and large seeds, I have not discovered that they make use of any of them for food. They appear to be a selection for shade, and so far I have not observed that they have any other use. If, however, after a more careful investigation it shall be discovered that they cultivate the vines, trees and fruitful shrubs for the double purpose of both shade and food, we must accord to them a share of sagacity and far-reaching forethought almost incredible.

I have occasionally discovered colonies of small sized red ants, which in form resemble the smallest type of the cutting ants. They dwell in the ground. I have not seen them cutting or carrying leaves. I have observed them thickly covering a greasy rag, places where syrup had been spilt, and where coffee grounds had been thrown aside at my hunting camps. They are not often met with, and as I now think, never will be, so long as the superior and very numerous race of cutting-ants inhabit the land.

The smallest type found in the cities of the cutting-ants, which I have before alluded to as being slaves, are in shape, size, color, and all their peculiar motions, precisely the same. How happens it that the same species of ant should occupy two very distinctly marked conditions? In one he dwells in small colonies, makes very little mark, is never wealthy, and does not remain long at the same station. In the other he is a slave!

How the cutting-ant manages to make slaves of the smaller race is as yet an unsolved question. The cutting-ant does, to be sure, perform all his thieving operations at night, or by the aid of an underground passage, if in the day time. Consequently our observations on the mode of carrying on the slave-trade must necessarily be tedious and limited. But the cutting-ants have what I take to be slaves in great numbers; and the same type that constitutes their slave population, is found sometimes free, but very poor and in straggling communities.

The fact that these little sand-carrying ants are a servile race, I think cannot well be denied. If they are produced from the eggs of the cutting-ant by a peculiar process of feeding, as is the case in producing the various types found in a community, or hive of honey bees, then the conclusion will follow, that there are no proper communities of the smaller type, and the little nests that I have occasionally seen of them, were nothing more than companies of badly managing absconded slaves.

26th February, 1861. There was a heavy rain last night. To-day it is very clear and pleasant; thermometer 70°. Everything that has life in it or can grow is in motion. I was out on the prairie botanizing, and while resting in the shade of a large live-oak which was nearly in full bloom, I discovered great numbers of all sizes of the cutting-ants ascending and descending the tree. On the ground beneath the tree were thousands of the ants carrying

1867.]

pieces of the leaves of various plants. The greater portion were carrying the leaves of the live-oak. Some of the leaves were faded and nearly dry, and all were the growth of the previous year. Seeing no ant hill near I undertook to find out how far they carried their leaves through the thick grass. In a short time I discovered that they carried them above ground but a small distance to a little pile of leaves and trash, under which they went dragging their cut leaves with them. Turning up the little pile of leafy trash, which seemed to have been driven there by the winds, in a depression of the ground that was probably an old horse track, there was a hole a full inch in diameter. Not a particle of dirt had been thrown out around it, and yet the hole was large and slanted away to the northwest. There were thousands of the ants at work in the shade of the live-oak, gathering up the leaves that were being constantly cut down from above, and on closer scrutiny I found several other holes into which they were going with leaves. These holes also slanted off under the surface, but had no earth thrown out around them, and were all alike concealed with leaves and little sticks. All the holes were crowded with the ants going in with leaves, or coming out empty. With such a number of ants and so many holes one would expect to find heaps of earth piled out around them, but such was not the case. The holes were the outer termini of the subterranean passages they had run out from their city, about fifty yards distant, and piled on their city mound lay the sand that came from the passages. These passages, or tunnels, are constructed for the purpose of avoiding the almost insurmountable difficulty they would have to encounter in the effort to carry their leaves through the tangled grass; and also apparently to make it possible for them to obtain food in times of scarcity during the cold weather. The cutting-ants are very easily stiffened with the cold air, and cannot succeed in scrambling through fifty yards of thick grass with a leaf of a cold day. But with the underground roads, in almost any kind of weather, they can go to the terminus, hastily run out and snatching up a recently fallen live-oak leaf, take it home through the tunnel without difficulty.

I saw the ants carrying nothing but leaves during this day's observation, neither have I ever observed this species collect any other kind of food except small flowers and the petals of larger ones; but these are no more than tender leaves.

At the ant city there appeared to be a great turn out of the ants this fine day. I noticed four sizes of them. Most of the slaves were engaged packing out sand upon the city mound. There were, however, a considerable sprinkling of them in company with the larger sizes packing leaves. I noticed also a great number of their giants, walking to and fro with the laborers, but they performed no work that I saw. The giants are large, and have a large head with strong mandibles. They are well-formed for the execution of much of their kind of labor; but I did not discover that they did any work, though they were passing up and down the tree and along the road with the laborers all the time. All the small ones—the slaves—and the second sized ones—which may also be slaves—were unremitting in their labors. The third size, or class, also carried leaves quite busily.

This species of ant often carry their subterranean roads to the distance of several hundred yards from the city in grassy districts, but where the grass has been destroyed, they do not construct the underground passages, but travel over land in nicely cleared out roads, which are seen radiating from the city mound and extending to various trees, or spots of herbage which produce suitable leaves for their subsistence. To see one of these well-cleared roads extending in a continuous line from the city to some tree or garden two or three hundred yards distant is indeed remarkable. This fact, in a district nude of grass, occurs so often that it cannot be attributed to chance, or blind instinct. Some of the engineers in their excursions in search of supplies, often wander to the distance of four or five hundred yards, or even further, and finding a plentiful source of good food, would find no difficulty in con-

[Feb.

ducting parties the best route to it; and soon a good smooth road is constructed, over which in crowds the workers are seen through the night, or in cool cloudy days, transporting the leaves to the city. This is their mode, invariably, in a country where the grass has been destroyed, and we can see and understand the method and the purpose for which they work. But in a country which is heavily coated with high grass, it is not so easy to discover by what process they lay off a tunnel and successfully carry it in a direct line to the selected tree or garden spot a quarter of a mile distant, and sometimes beyond a considerable streamlet of running water.

On one occasion, on a log that lay across the Ye Gua Creek, the ants passed over to a gentleman's garden and were rapidly cutting his vegetables to pieces. The owner hoping to rid the garden of these troublesome insects, cut the log away and it floated off down the creek. He was mistaken in his calculations, for it was but a few days after when the ants were ravaging the garden in as great numbers as they were previous to the removal of the log. After searching unsuccessfully for some interlocking tree that might afford them a passage, it was observed that the ants came out from several holes, situated on the creek side of the garden. Subsequently it was discovered that, on a large ant mound crowning a sandy point near the edge of some post-oak timber, two hundred yards from the creek, there were quantities of the black soil of the Ye Gua bottom thrown out, proving that the second visit of the ants to the gentleman's garden had been effected by a tunnel beneath the bed of the creek; the channel of the creek, at that place is fifteen or twenty feet deep, and from bank to bank on top of the bluff about thirty feet.

By what degree of the *instinctive* powers was all this engineering and truly great project accomplished.

I have never seen the cutting ants fighting among themselves, or with any of the other species. I look upon them as the most peaceable, the most sagacious, and at the same time the most destructive of the ant kind.

March 5th.

The President, DR. HAYS, in the Chair.

Thirty-six members present.

The following papers were presented for publication:

"On the Structure of *Lopezia*." By Thomas Meehan.

"Mammalogical Notices." By J. H. Slack, M. D.

March 12th.

MR. CASSIN, Vice-President, in the Chair.

Forty-two members present.

The death was announced of Prince Maximilian, of Wied, a Correspondent.

The following was presented for publication:

"The necessity of Nebular Rotation." By J. Ennis.

Prof. Cope exhibited the fossil skull of a large turtle, from a soft granular limestone belonging to the cretaceous formation of Barnsboro, Gloucester Co., N. J. It was characterized under the name of *Euclastes* platyops. The length of the skull is 11 inches; its breadth 8½ inches.

1867.]

March 19th.

The President, DR. HAYS, in the Chair.

Thirty-nine members and correspondents present.

The following were presented for publication :

"On *Euclastes*, a genus of extinct *Chelonidæ*." By E. D. Cope.

Prof. Leidy exhibited a number of plates of a forthcoming work on the extinct mammals of Nebraska and Dakota, comprising about seventy species. Among these he exhibited the representation of a skull of a new ruminant which he characterized under the name of *Agriochœrus latifrons*.

In answer to a question, Prof. Leidy remarked that he had never detected the slightest evidence of the former existence of the *Hippopotamus* in America. Remains reported as such had turned out to be inferior tusks of *Mastodon*, &c.

Prof. Cope presented to the Academy a young specimen of the whale, known as the *Bahia Finner*, procured near Bahia, Brazil, the length of which was 21 feet. He said it belonged to the genus *Megaptera*, Gray, with the humpback whales of sailors. The evidence consists in the very short di- and parapophyses of the cervical vertebræ and the absence of all trace of acromion and coracoid processes. The orbital processes of the frontal are narrowed externally and the muzzle considerably narrowed. Judging from the name, it possesses a more fully developed dorsal fin than the other *Megaptera*. It should be called *Megaptera braziliensis*.

A letter was read from Prof. J. P. Kirtland, of Cleveland, Ohio, giving an account of the death of Major Robert Kennicott, which occurred on the 13th of May, 1866, at Nulato, on the Yukon River, 600 miles above its entrance into Behring's Sea.

March 26th.

The President, DR. HAYS, in the Chair.

Thirty-nine members present.

The resignation of membership of O. N. Barnes was tendered and accepted.

The death was announced of Washington L. Sherman, M. D., U. S. A., a member, on May 4th, 1865.

The following were elected members :

Samuel Ashhurst, M. D., Francis Ashhurst, M. D., Rev. I. L. Beman, Charles Smith, Thomas Earp, Charles Taylor, Moro Phillips, Samuel Welsh, Lewis Cooper, Benjamin B. Comegys, S. C. Morton, Mrs. E. P. Long and Miss Bohlen.

The following were elected correspondents :

Hon. George P. Marsh, Florence, Italy ; Dr. Gideon Lincoecum, Long Point, Texas ; John R. Willis, Halifax, N. S. ; and Samuel H. Scudder, M. D., Boston, Mass.

On favorable report of the respective committees the following papers were ordered to be published :

[March,

On the Structure of *LOPEZIA*.

BY THOMAS MEEHAN.

Lopezia, with its single stamen, is considered as an anomaly amongst onageraceous plants; but an analysis of *L. miniata*, *D. C.*, shows the structure to be on the same regular plan with the rest of the order. The genus is described as having a four-cleft calyx, which for practical purposes it may be considered to have,—but two of the segments evidently belong to the corollate system, and two of the petals to the staminate axis, making the arrangement, from a structural point of view, to be a two-cleft calyx, four petals, and four stamens.

It may be well to observe here, that in consequence of the spiral nature of the growth of plants, the different parts of what we term the same axis are not developed simultaneously. Stamens, petals, sepals and leaves, are, therefore, though apparently from the same axis or verticil, rarely of the same size or form, and perhaps a careful microscopic examination might show that they never are. We may assume that the parts of the verticil which have the priority of development, will have at times a mechanical as well as physiological influence on the form or direction of the later and weaker parts; and when the contraction of the spiral line is very rapid, and the axes of the different verticils brought in close contact, the lowermost and strongest influence the one above.

This influence is clearly traced in *Lopezia*. Lindley remarks (*Vegetable Kingdom*, page 724) that "there are really two stamens, one perfect and bearing an anther, the other sterile and in the form of a spoon-shaped petal." This spoon-shaped petal is evidently of the same axis, but with a priority of development, which enables it to grasp with its lamina the anther of the weaker stamen. In its expansion it thus draws the stamen down with it, which, in turn, grasping the pistil by a winged filament gives an irregular direction to the central axis by this simple mechanical means. The progress of this development is very interesting. The lamina of the sterile petal grasps the anther till long after the pollen sacs have burst, and remains fast in its hold until some insect or other external agency touches the petal, when the stamen is released with great force, and the petal springs backwards instantaneously on to the already expanded and spreading calyx, and the stamen at the same time bends back in an opposite direction, scattering its pollen on the back of the insect or the other disturbing cause. If this liberation has not been effected at an early age, the stamen flies back at once into a position regularly corresponding to the sterile petal on the opposite side; but if early the grasp it has on the pistil by its clasping filament prevents it doing so. The whole arrangement with the progress of the development seems the most effectual contrivance that could possibly be devised to prevent a flower from fertilizing its own stigma.*

Beneath these two stamens are two gland-bearing petals, which the analyzer will have no difficulty in deciding to be two stamens early developed, and partaking, in consequence, of a petaloid character. By the overlapping of the bases when young these have been pushed out so as to be finally developed in one direction, and beneath them are two perfect petals, also twisted to go in one direction by the same law.

We now come to the four-cleft calyx, and we notice that no sooner are the segments fairly expanded than the two weaker ones take the direction towards each other which characterizes the sets above them, leaving the two-cleft calyx to hold its position unchanged as such. These petaloid sepals have evidently been brought down to the position of the true sepals mechanically, by a temporary cohesion. If we assist very lightly a flower to open it bursts easily into two parts, almost precisely like the two-cleft calyx of *Circæa*, its

* This elasticity has been noticed in *Lopezia racemosa*, Cav., by Curtis in Bot. Mag. t. 254.

next affinity, showing clearly that its most natural division is on the binary plan.

It may be further noted in regard to *Lopezia miniata*, the only perennial suffruticose species I believe, that the smooth stem, which is considered a good character in distinguishing it, is only extant while the plant is in a flowering state. It has two distinct systems of growth. During the earliest it is as hirsute as the other species; at the conclusion of its early summer growth it starts anew with a growth which ultimately flowers, and it is this only which is destitute of hairs.

These notes are made from cultivated plants.

MAMMALOLOGICAL NOTICES.

BY J. H. SLACK, M. D.

ANTHROPOPITHECUS TSCHEGO.

Troglodytes tschego Duvérnoy, Arch. du Mus., vol. ix. 1857.

Troglodytes calvus Du Chaillu, Proc. Bost. Soc. Nat. Hist., vol. vii. p. 267, 1860.

Size about equal to that of the *Anthropopithecus niger*. General color black, sometimes grey in old age. Head bald, black and shining; chin of adult bearded. Ears large, much larger than those of the *Anthropopithecus gorilla*, though smaller than those of the Chimpanzee.

Habitat.—The deep forests, and the table lands of equatorial Africa.

Figure of skeleton, Duvérnoy, Arch. du Mus., vol. ix.

Figure of entire animal, Du Chaillu, Equatorial Africa, p. 406.

A fine adult skeleton of this rare anthropoidal ape, first noticed as a distinct species by the late lamented Duvérnoy, has been for some time in the collection of the Academy, and has been regarded until lately as that of the *A. niger*. For a full account of the osteological difference between the two species, I must refer to Duvérnoy's most valuable and interesting paper; though, on placing the skulls of the two animals side by side, their specific differences must be apparent to the most superficial observer.

A careful study of the species appears to me to clearly prove the fallacy of regarding the *A. gorilla* as the type of a distinct genus, as has been done by St. Hilaire, the *tschego* combining in a remarkable degree the characteristics of both genera. The cranial crests, so much insisted on as generic characters of the *gorilla*, are to be seen, though in a less degree of development, in the *tschego*, while with the black face of the *gorilla* are associated the large ears of the chimpanzee, and, in fact, all the characteristics of the animal are intermediate between those of the two genera. The names *tschego*, *nshego* and *nchéko* appear, from the accounts of travellers, to have been applied indiscriminately by the natives of equatorial Africa to all species of anthropoidal apes.

To this species has been ascribed the faculty of constructing a nest or shelter among the higher branches of trees, as a protection from the inclemency of the weather during the rainy season. This, according to Du Chaillu, (Equatorial Africa, p. 407) is covered with leaves, compactly laid together, at such an angle as to readily shed the rain. The branches are fastened to the trunk of the tree with vines; the roof is generally from six to eight feet in diameter. Surely this roof-constructing power must place its builder the highest in the scale of the quadrumana.

The only figure of this animal in the flesh that I have met with, is to be found in Du Chaillu's work. The so called young in the same plate, however, resembles in a most remarkable degree a daguerreotype from life of a young *A. niger*, which died some years ago in the Jardin des Plantes at Paris. It must therefore be received "cum grano salis."

[March,

I have accepted for the genus the name given by De Blainville in his lectures, 1839, and quoted by S  n  schal (Dictionaire pict. de Hist. Nat., article *Quadrumana*, 1839; Hollard, *Elem. de Zool.*, 1839; Pouchet, *Zool. Class.*, vol. i. p. 39, 1841, et al.) as not only being much more appropriate for a genus of animals living among the branches of trees, but also as the name *Troglydytes* is preoccupied, having been given to a genus of birds by Vieillot (*Oiseaux de l'Amerique Septentrionale*, p. 52, 1807) five years previous to its having been bestowed upon this genus of mammalia by Etienne Geoffrey St. Hilaire (*Tableau des Quadrumanes*, *Annales du Mus.*, 1812).

A. tschego—entire skeleton.

Specimen No. 564.

| | |
|--|------|
| Muzzle to last cervical vertebra | 14 |
| " " dorsal " | 21.7 |
| " " lumbar " | 24.5 |
| " tip of great toe | 59.5 |
| Height | 46 |
| Arm | 31 |
| Leg | 26 |
| Humerus | 11.5 |
| Femur | 11 |
| Hand | 8.5 |
| Foot | 6.25 |

From materials in the collection of the Academy I am enabled to present the following table of measurements of the skulls of the allied species of the genus *Anthropopithecus*:

The method of measurement adopted is that suggested by Dr. J. A. Meigs, in his paper "on the Measurements of the Human Skull."

| | No. 564. <i>A. tschego</i> . | No. 156. <i>A. niger</i> . | No. 155. <i>A. niger</i> . |
|----------------------------|------------------------------|----------------------------|----------------------------|
| Occipito-frontal | 5 | 5.45 | 5.28 |
| Frontal | 4.2 | 4.2 | 4.45 |
| Bi-temporal | 3.7 | 3.7 | 3.8 |
| Bi-parietal | 3.4 | 3.7 | 3.75 |
| Frontal arch | 8.2 | 8.8 | 8.8 |
| Parietal arch | 9.2 | 10 | 10 |
| Occipital arch | 7.2 | 7.9 | 7.75 |
| Horizontal periphery | 6.25 | 6.75 | 6 |
| Meato frontal | 3.75 | 4.2 | 4.2 |
| Meato parietal | 1.9 | 1.8 | 1.8 |
| Meato occipital | 3 | 3 | 3 |
| Meato malar | 2.7 | 3 | 3 |
| Meato alveolar | 6.5 | 6 | 6 |
| Nasal alveolar | 2.2 | 2.2 | 2.2 |
| Bi-zygomatic | 4.1 | 4.5 | 4.2 |
| Facial angle | 50° | 47° | 45° |
| Cranial capacity | 22 in. | 20 in. | 20 in. |

CYROCEPHALUS DOGUERA, Pucheran and Schimper, *Rev. et Mag. de Zoologie*, 1856, p. 96; 1857, p. 57.

General color olive-brown, the brown predominating on the body and external surface of posterior limbs; hands very dark brown, nearly black; sides of head, belly, and internal surface of limbs yellowish-white, the hairs of body annulated with alternate bands of black and brownish-yellow, the brown predominating upon the tail, which is terminated by a long tuft of hairs. Face naked.

Habitat.—Central Abyssinia.

1867.]

Measurements.

1013. Mounted skin, ♂. Abyssinia.

| | |
|-------------------------------|------|
| From tip of nose to eye..... | 5- |
| " " ear..... | 8- |
| " " occiput..... | 13-4 |
| " " tail..... | 38- |
| Tail to end of vertebrae..... | 19- |
| " " hairs..... | 22- |
| Length of fore foot..... | 20- |
| " " hind feet..... | 19-5 |

The specimen in the collection of the Academy above described was obtained by me for the institution from Messrs. Verreaux freres, of Paris, in 1861. It, with the type of the species, now in the magnificent collection of the Jardin des Plantes, was brought by Mr. Schimper from Central Abyssinia about the year 1855. These two specimens are, as far as I am aware, the only ones known to naturalists. Both are full-grown males.

M. Schimper states that the animals of this species are gregarious in their habits, he having met with them in troops of from one to two thousand individuals. They hunt their prey, which consists mainly of the small ruminants, in a manner similar to that of a pack of hounds; following the quarry until it is exhausted by fatigue, and then capturing and devouring it. Similar habits have been ascribed by travellers to the *C. porcarius*. It is also stated that the lion and leopard are unknown in the region inhabited by this baboon. A glance at the specimen under consideration would convince the observer that it is of a most ferocious disposition; the large canines and heavy lower jaw would be useless to an animal of quiet and peaceful habits, and, in fact, M. Schimper also informs us that it wages a continual war against the *Dschellada* (*Theropithecus gelada*),* which inhabits the same locality.

The only baboon with which this species can be confounded is the *C. porcarius*, the form, size and habits of the two species being somewhat similar; but they can readily be distinguished by their coloration, the *porcarius* being much darker.

I have not been able to compare the skulls of the two species, but from an examination of the only specimens known, both being mounted skins, it would appear that the occipito-mental diameter of the skull is proportionately much greater in this species than in the *porcarius*.

Mycetes palliatus Gray, Proc. Zool. Soc. 1848, p. 138, fig. vi.

Under this name Dr. Gray has figured and described a monkey from South America, which presented most certainly all the characters required for the formation of a new species, though the specimens were young; still the long hair of the back and the coloration were very different from any of the known South American quadrumana. Having received four specimens from the Smithsonian Institution which had been collected by the Atrato Expedition, I accepted the species in my Monograph of the Prehensile-tailed Quadrumana (Proc. A. N. S. 1862, p. 519). I have since had an opportunity of examining other specimens from New Grenada, and have discovered, to my surprise, that it is merely the young of the *Aluata niger*. When very young the animal is of a pale straw color, passing through all the intermediate shades of coloration in its pelage during its youth, and in adult age becoming entirely of an intense black color. The coloration of the *palliatus* is that of the period of the commencement of the second dentition.

MACACUS FUR, sp. nov., vide plate.

General color reddish-brown, dashed with black, the hairs of the body and external surface of limbs being black throughout the basal two-thirds of their

* A fine suite of specimens, male, female and young of the *T. gelada* have been obtained from M. Verreaux, and are now in the Museum of the Academy.

length, and tipped with reddish-brown; breast, belly, and internal surface of limbs grey, somewhat darker on posterior limbs; tail, a tuft of hairs on the superciliary ridge, and a line extending from the external angle of the eye to base of ear, black; tail long, about equal to the body in length; hands dark brown; fingers black; hair of occiput laying flat, neither forming a crest nor radiating from a common centre.

Measurements.

| | |
|------------------------------------|------|
| Specimen No. 1254. Philippines. ♂. | |
| From tip of nose to eye..... | 2. |
| “ “ ear..... | 4. |
| “ “ occiput..... | 8. |
| “ “ tail | 23. |
| Tail | 22.5 |
| Length of fore feet..... | 11. |
| “ hind feet..... | 13. |

Skull (occiput broken). Bi-temporal, 2.3; bi-zygomatic, 2.7; fronto-mental, 3.2. Lower jaw: angle to symphysis, 2.6; angle to condyle, 1.2.

This *Macaque* was obtained for the Academy some years since in Paris, by myself, and as great confusion occurs in regard to the species of this genus, I would have had great reluctance to describe it as a new species, had I not had the opportunity of comparing it with the various specimens in the great museums of both Paris and London.

The only previously described species of *Macacus* with long tails, and without radiating hairs or crests upon the top of the head, are the *M. aureus* (*Is. Geoff.*, Voy. de Belang. 1830), of which the general color is pale reddish-yellow, with limbs grey on their external surfaces; the *M. cynomolgus* (Desmarest, *Mammalia*, p. 65, 1820, *Simia cynomolgus* Linn.), which is olive, dashed with black, and tail much longer than the present species. The locality is also different. I have examined specimens of the *cynomolgus* from India, Bengal, Mauritius, Java and Sumatra, but have never met with one from the Philippine Islands; the *M. palpebrosus*, which is thus described by St. Hilaire (*Cat. des Primates*, &c., Paris, 1851, p. 93): “Les paupières sont blanches, ainsi qu’une tache placée de chaque côté au dessus de la paupière, et contrastant avec la couleur foncée soit de l’espace intermédiaire au deux taches, soit de la face;” and an albino specimen in the museum of the Jardin des Plantes, described by St. Hilaire as *M. Philippinensis* (*Arch. du Mus.*, 1843, t. xxxii. p. 568), which presents no distinguishing specific characters, —the form of the head being, however, entirely different from that of the *M. fur*.

I have been informed by M. Jules Verreaux, who has spent some time at the Philippine Islands, that this animal is found only on the island of Luzon, and is there, unfortunately for the inhabitants, quite common. Though inhabiting the mountains and dense forests in the interior of the island, they frequently make nocturnal excursions to the sea-coast in large troops, utterly destroying the crops planted by the natives, especially those of turnips, a root of which they appear to be particularly fond. The specific name is bestowed upon them on account of their thieving propensities. Their flesh is eaten by the natives, and considered a great delicacy.

GALAGO ELEGANTULUS Slack, Proc. A. N. S. 1861, p. 153.

Microcebus elegantulus J. Le Conte, Proc. A. N. S. 1857, p. 10.

Galago crassicaudatus Gray, Ann. Mag. Nat. Hist. vol. viii. 1861, p. 63.

Otoliscus apacalis Du Chaillu, Proc. Bost. Soc. Nat. Hist. 1861.

General color dark cinereous, the hairs being tipped with reddish-brown and grey during the basal two-thirds of their length. Tail cylindrical and bushy, tipped with white.

Dr. Gray (*loc. cit.*) regards this species as identical with the *Galago crassicaudatus* 1867.]

caudatus of Etienne St. Hilaire (Ann. du Mus. 1812, p. 166). It is, however, in my opinion, entirely distinct. The specimen in the collection of the Academy, from the Du Chaillu collection, though adult, as may be seen by the examination of the skull, is at least one-third smaller than the typical specimen of the *G. crassicaudatus* in the Paris museum; the nose is more pointed, and the general coloration very different.

The white tip of the tail, which is considered by Dr. Gray as accidental, I regard as a well-marked specific character, it being plainly indicated in two very young specimens, presented to the Academy by Dr. H. A. Ford several years since. One of these is decolorized by having been preserved in alcohol; the other is entirely of a dark slate color, with the exception of the white apex of the tail.

A curious typographical error is to be found in Maj. Le Conte's description of this species: the head is described as 1 foot 9 inches in length; for "head" read—from muzzle to tip of tail.

DAUBENTONIA MADAGASCARENSIS Etienne St. Hilaire, Decade Philosophique, t. iv. p. 193, 1795.

Cheiromys Madagascarensis Cuvier, Anat. Comparée, vol. i. 1800; Dict. des Sciences Nat.

This most curious mammal, whose place in the scale of nature was for a long time a point of discussion between the most eminent European naturalists, and which, even at the present day, has been regarded by some as a rodent (vide Tenney, Natural History, &c., N. Y., 1865, p. 2, fig. 57), though the manner of growth of its incisors is entirely different from that of the rodentia, was first described by the elder St. Hilaire under the generic name of *Daubentonia*, in 1795. In 1800, Cuvier, who long held that the creature was a rodent, re-described it under the name of *Cheiromys*, $\chi\eta\rho$, manus; $\mu\acute{o}\varsigma$, mus. In the Diction. des Sciences Naturelles, 1816, Art. Aye Aye, he gives his reason for the change, made, it is said, with the consent of the original discoverer, in the following words: "Nous avons préféré *Cheiromys*, parceque l'usage de donner des noms d'homme n'est point reçu en zoologie comme en botanique." Is this sufficient ground for a change? In our opinion certainly not, unless the absurd rule first promulgated by the French naturalists, which would compel us to "considérer comme non avenus (*toutefois en les citant en synonymie*) les noms tombés en désuétude" (*Is. Geoff. St. Hilaire, Cat. des Primates*, p. xi,) should be generally adopted, which would still further confuse the work of zoological nomenclature, begun by Adam, and far from being completed at the present day.

April 2d.

The President, DR. HAYS, in the Chair.

Thirty-eight members present.

The following papers were presented for publication:

"On dioicæus forms of *Vitis vinifera*." By Thomas Meehan.

The death was announced of Dr. George Jäger, of Stuttgart, Correspondent.

April 9th.

The President, DR. HAYS, in the Chair.

Thirty-six members present.

The following papers were presented for publication:

"Description of New Texan Myriapoda." By Dr. H. C. Wood, Jr.

[April,

"On two new Minerals from Chester Co." By Isaac Lea, LL. D.
 Prof. Cope exhibited several vertebræ of a Gavial from the cretaceous marl of Burlington Co., N. J., and proposed for the new species the name of *Thoracosaurus brevispinus*.

A letter was read from George W. Tryon, Jr., offering his collection of Shells to the Academy on certain conditions, which, on resolution, were accepted. The collection consists of over 10,000 species, in addition to 100 jars of alcoholic specimens, mainly of naked mollusca. The collection is particularly rich in recently described species.

April 16th.

The President, DR. HAYS, in the Chair.

Thirty-eight members present.

The death was announced of Dr. C. W. Pennock, on the 14th inst., a member.

April 23d.

The President, DR. HAYS, in the Chair.

Thirty-three members present.

The following was presented for publication :

"A third study of the Icteridæ." By John Cassin.

The death was announced of Mr. Samuel C. Morton, a member.

April 30th.

The President, DR. HAYS, in the Chair.

Thirty-three members present.

The following were elected correspondents :

Col. F. F. Cavada, U. S. Consul at Trinidad ; Eugene Gaussoin, of Baltimore ; Alpheus Hyatt and F. W. Putnam, of Salem, Mass.

The following were elected members :

Wm. Hay, James H. Little, Beauveau Borie, J. Ross Snowden, Wm. W. Keen, Jr., M. D., Edward J. Nolan, M. D., Charles Magarge, Charles S. Coxe, Isaiah V. Williamson, Matthew Baird, Charles Wheeler, Robert H. Gratz, Adolph E. Borie, H. Pratt McKean, Geo. F. Tyler, Wistar Morris, Joseph F. Page, Israel Morris, A. Campbell, Thomas A. Scott, H. H. Houston, Charles Spencer, Gustavus S. Benson, Wm. A. Blanchard.

On favorable report of the respective Committees, the following were ordered to be published :

On *EUCLASTES*, a genus of extinct Chelonidæ.

BY E. D. COPE.

This genus is established on a species represented by a single imperfect cranium, procured by Thos. Heritage from his marl excavations near Hurffville, in Camden Co., N. J. The matrix in which it is preserved is very similar.]

lar to that near Vincenttown, in which the cranium of the *Thoracosaurus neocæsariensis* was discovered, being a coarse granular limestone in many places, with numerous black rounded grains of perhaps phosphate of iron or hornblende. It is abundantly penetrated by *Teredo tibialis* Mort., contains *Gryphaea vomer* abundantly, and has afforded the only specimen of *Aturia* from the eastern cretaceous beds, which I have called *A. paucifex*.* The bed is but a few inches thick, and is frequently interrupted, and is over and underlaid by the green sand of Cook's middle bed.

The physiognomy of this large turtle, in the obliquely expanded *xygomata* and short muzzle, is like the *Pleurodire* genera *Podocnemis* Wagl. among recent *Chelonia*, and *Bothremys* Leidy, of the same age, among extinct forms. Its completely overarched temporal fossæ add to the impression of its affinity to the former genus, but on inspection of the vomer, it is found to be, as in the true *Cheloniidae*, largely developed on the palatal surface between the o. o. maxillaria, and to extend to a posteriorly situated nareal opening. Though this element is unossified in the *Chelonioid* types of *Pleurodira*, *Peltocephalus* and *Podocnemis*, it is well developed in the family *Chelydridæ* (Agassiz), and the peculiarity of the cretaceous species might still exist in this sub-order. As it is a matter of much interest to determine the precedence in time of the two sub-orders of *Chelonians*, I have taken pains to remove the matrix from the orbital and nasal cavities, so as to determine the structure of the prefrontal bone. As I have elsewhere pointed out, this sends downward a column to the vomer, either vertically or directed obliquely inwards, in all the *Cryptodira*, while in the *Pleurodira* the column is wanting.

It might be reasonably anticipated that, in the period of the Cretaceous, the less typical sub-order now characteristic of the Southern Hemisphere would abound, if not entirely prevail. Its genera occur in the different epochs of the Jurassic period, and Prof. Agassiz suspects one, at least, of the Cretaceous *Chelonias* of Europe to be really *Pleurodire*. The species herein described, however, I must refer to the true *Cheloniidæ*, and consider it as an undescribed genus, having marks of resemblance to the *Trionychidæ* and *Hydraspididæ*. It differs from *Chelonia* in its large naso-palatal foramen, thus resembling *Trionyx*, in the complete flooring of the nasal meatus by the vomer and palatines as far back as the line of the inferior openings of the orbits, and by the shallowness of the palate and slight development of the alveolar margin.

The diagnosis will be as follows: that of *Bothremys* a *Hydraspid*, which has furnished the only other cranium from the same formation, is introduced. It also has the vomer osseous, extensively in contact with the maxillaries on the palatine surface.

BOTHEMYS Leidy. Posterior nares separating vomer from o. o. palatina; pre-maxillary margin concave, involute; alveolar surface profoundly concave, vomerine surface a sulcus. Nasal meatus floored in front.

EUCLASTES Cope. Maxillaries and palatines separated throughout by the prolonged vomer; posterior nares opposite palatal front margin of orbits; pre-maxillary margin projecting, beak-like; alveolar face little concave, vomer forming a central ridge. Floor of nasal meatus perforate for hook of mandible.

While *Bothremys* had an inferior mouth and projecting muzzle, as in the modern *Hydraspidæ*, the nostrils of the *Euclastes* were superior and behind the short projecting beak. The orbits are not, as in the *Macrochelys* of the Mississippi, far anterior and reduced in size, but their centres are distant from the end of the muzzle (measured axially) more than one-third the total length of the cranium.

The descending portion of the prefrontal is very wide, and equal to the width

of the maxillary outside the lachrymal foramen; the latter is small. Internally the columns of the prefrontals converge below to nearly an acute angle, and are directed forwards along the vomer. They restrict the nasal meatus extensively, leaving its diameter less than that of the columns. On the muzzle the prefrontals have but a short common suture, admitting the frontal far between them. The internal nostrils have a diameter each side the septum, equal to that of the meatus between the prefrontals.

EUCLASTES PLATYOPS Cope.

Premaxillaries narrow, rounded in front, maxillary outline nearly straight to below anterior rim of orbits, where the breadth of the muzzle is four inches, length to end of muzzle only two. Plane from top of prefrontals to maxillary margin straight, oblique. Maxillary margin with a gentle sigmoid flexure. Squamosal much expanded below and behind orbits. Frontal region flat, parietal rising behind. Nasal meatus subquadrate, slightly narrowed below, its palatal foramen with a free lateral osseous margin. Alveolar ridge divergent, little projecting above the oblique surface; the latter is most concave behind on each side the vomer, and presents no ridges, and few nutritious foramina. Line of common suture of o. o. maxillaria in front of vomer, in a sulcus. Palatines cuneiform with everted margins posteriorly, latter most elevated on each side the small choanal opening, which is bounded in front by the projecting posterior knob of the vomer. The maxillaries are very massive, and underlie more than two-thirds the area of the orbits; they receive a very extensive descending portion of the prefrontals, their union extending so far towards the median line as to leave but a narrow nasal meatus. This offers a powerful resistant face to the motion of the mandible. The posterior, orbital margin is .75 inch in thickness, and is at right angles to its alveolar margin. Pterygoids almost entirely broken away. The following measurements will furnish the best data for a comprehension of the form in detail:

| | In. | Ln. |
|---|-----|-----|
| Total length cranium..... | 11 | |
| Breadth behind orbits..... | 8 | 6 |
| " between posterior margins orbits..... | 5 | 2.5 |
| Least interorbital width..... | 2 | 2.5 |
| Width of nasal meatus..... | 1 | 2.5 |
| Depth premaxillaries..... | 1 | 1 |
| " maxillary at middle orbit..... | 1 | 3.5 |
| " squamosal at zygomatic arch..... | 2 | 2 |
| Length naso-prefrontals..... | 2 | 3 |
| " common suture..... | | 6.2 |
| " common suture frontals..... | 2 | 4 |
| " from anterior margin orbit to nasal meatus..... | | 11 |
| " from premaxillary margin to end vomer..... | 3 | 9 |
| Width posterior nares together..... | 1 | 1.5 |
| " palatine bone opposite end of vomer..... | | 9 |
| " vomer near anterior extremity..... | | 7 |
| Greatest diameter of orbit..... | 2 | 6 |
| Least " "..... | 2 | |

The broad, regular alveolar surfaces have no doubt supported a massive corneous table, in some degree like that of *Platypeltis ferrox*, and with little or no external cutting margin. This arrangement, as well as the compactness of structure, is appropriate to a nutrition dependent on crushing more or less hard bodies, as molluscs. That the *Ostrææ*, *Terebratulæ*, etc., of the sea coasts or estuaries in which it lived formed much of its food, is therefore quite probable.

Estimating the proportions to have been similar to those of *Hydraspis maximiliani*, the dimensions of the *Euclastes platyops* were—

1867.]

| | Fr. | Ln. |
|---|-----|-----|
| Length from end muzzle to end tail..... | 6 | 7½ |
| “ of carapace | 4 | 7 |
| Width of plastron at middle..... | 3 | 0½ |

Note on Dioecous forms of *VITIS VINIFERA*, L.

BY THOMAS MEEHAN.

The different species of *Vitis* are so closely allied that the systematist is often puzzled to find distinguishing characters, and hence liable to give too much importance to points really of little value.

De Candolle, in his *Prodromus*, divides *Vitis* into two sections, according to the inflorescence,—one, natives of this country, with imperfect flower (*Dioicæ aut polygamæ, Americanæ*); the other, perfect and Old-world forms (*Hermaphroditæ, in orbe veteri indigenæ*),—but as *Vitis* is not of a true declinuous type, but of that class which suppresses or develops its sexual organs according to circumstances, such a division is at best of doubtful value.

Vitis vinifera, the great type of Asiatic forms, has not probably been observed closely in a natural state; and under cultivation, in the hands of cultivators who value the vine for its fruit only, barren plants would not likely be preserved. Yet pistillate or female plants do not seem uncommon, for De Candolle says (vol. i. p. 633,) “*Seminibus numero variis imo interdum omnibus abortivis*,” these seedless grapes being most likely the product of unimpregnated ovaries.

That male plants do exist is, however, proved by a specimen, in the Academy's Herbarium, of *Vitis vinifera mascula*, gathered near Naples by Tenore.

In the endeavor to distinguish forms of *Vitis vinifera* from American species, its hermaphrodite character is still often insisted on; but with the demonstration of the existence certainly of male flowers, and the probable existence of female ones, this distinction becomes too uncertain to be of much value.

Descriptions of new species of Texan MYRIAPODA.

BY DR. HORATIO C. WOOD, JR.

Genus CERMATIA.

C. LINCOLI.

C. dilute brunnea, linea mediana saturate viride et alteris lateralibus interdum obsolete ornata; stomatis dorsalibus singula maculis duis laete rubris marginata.

This handsome species is of a brownish color, with the dark green median stripe often involving nearly the whole of the posterior portion of the dorsum. The lateral stripes appear to be sometimes wanting. The head is marked much as in *C. forceps*; in the dried specimen it is of a nearly uniform reddish ferruginous color. The scuta are roughened with rather distant small spines; their margins are thin, elevated, without conspicuous spines. The antennæ are of the same color as the head, as indeed are all of its appendages. The spots bordering the dorsal stomata are somewhat kidney-shaped, and of a scarlet lake color.

The under surface of the body, the coxæ and femora, are of a light brown color. The tibiæ and tarsi are of a dark greenish tint. The metatarsi are of nearly the same tint as the head; the first article is about equal to the next five in length. The sterna are rather deeply impressed with a median longitudinal line. The body of the largest specimen in my possession is about seven lines in length.

The foregoing description is taken chiefly from dried specimens, in which the coloration, I presume, does not differ materially from that of life.

[April,

Dr. Lincecum states, in his letter accompanying the specimens, that their favorite haunts are under stones, in hollow logs, and especially about unused fire-places. He also says that they are not half the size of *C. forceps*. In dedicating this species to Dr. Lincecum, I do it as a well merited token of respect for his untiring zeal as a field naturalist, and for the liberality with which he furnishes others with the results of his own industry. I am indebted to the Doctor for all the species described in this paper.

Genus POLYDESMUS.

P. IMPURUS.

P. dilute brunneus fusco variatus; scutis rubro marginatis; scuto anale triangulari, apice elongato truncato; appendicibus masculis, robustis, spina terminale haud pilosa.

The color is a light brown, finely mottled with dark brown, the dark color predominating in the central portions of the scuta, the light on the lateral parts. The scuta are ornamented with a narrow reddish flesh-colored line both on their posterior and lateral margins, which is, however, more pronounced on the lateral margins; the first scutum has a similar line on its anterior margin. The vertex has a strongly pronounced median line. The antennæ are filiform, somewhat pilose, and like the ventral surface and pubescent feet, a light yellowish brown. The male appendages are robust, their blunt distal end is covered with long hairs, and gives origin to two spines, neither of which are hairy; the larger of these is regularly curved, except at its extreme point, where it is abruptly bent; the other is slender, curved, and acute. The total length of the body and head is about an inch.

This species is closely allied to *P. hispidipes*, differing from it, however, in coloring and in the form of the genital appendages. I have not examined any females. Dr. Lincecum informs me that it is rare in Texas, especially in dry seasons, and is found chiefly under old cow dung. Its favorite haunts suggested its name, although it is one of our handsomest species.

Genus IULUS.

I. CÆSIUS.

I. cæsius, brunneo annulatus; antennis filiformibus, modicis, pilosis; capitis vertice subnigra, superficie antica dilute brunnea, margine antico modice emarginato; scutorum lateribus canaliculatis; mucrone modice magno, recto, robusto; segmentis 56, haud pilosis.

The color of this species is a sort of bluish gray, more or less involved in the brown rings. The antennæ are slender, and not at all clavate. The sides are chased with moderately close channels, which on the anterior scuta are strongly pronounced, but on the posterior are somewhat obsolete. The last scutum is prolonged into a somewhat blunt mucro, at least the latter is quite obtuse in the only specimen which I have seen. The male genital appendages are composed, as in the allied species, of two parts. The chief of these gives origin on the outer part on each side to a process, which is bifurcated almost to its base; the arms which thus originate are separated by a narrow fissure, one of them is thin, broad, and distally narrowed to a point; it is so placed as to present its broad aspect somewhat obliquely towards the flank of the animal. The other is shorter, clavate, distally coarsely profusely pilose, and set as it were at an angle to the first, so as to face obliquely backwards. The inner portion of the male appendages consists on each side of two slender, subcylindrical, smooth processes, which are united at their bases; the shortest of them is nearly straight, the longer somewhat bent. The total length of my specimen is nearly two inches.

I. DIVERSIFRONS.

I. saturate brunneus, linea nigra mediana et seriebus lateralibus maculæ nigre ornatus; capitis vertice subnigra, superficie antica cinerea, margine antico distincte emarginato; mucrone modice magno, recto; segmentis 52.

1867.]

The antennæ of this species are filiform and pubescent. The male genital appendages are composed on each side of two parts, the outer of which is broad, thin, and very irregular, ending in two processes, of which the outer is short, very strongly expanded distally and pilose, and often of a black color; the inner is longer and more irregular, narrowing from the base, distally it is bent nearly at right angles to itself, ending in cylindrical points. The inner of the two parts is composed of a single irregular, thin process, which has at first somewhat of the swan-neck curve, and near its end is bent sharply at right angles to itself; it gives origin to two sharp spines, one arising from the angle and the other from the shaft, so as to be, as it were, shielded by the bent portion. The female appendages are similar to those of *I. impressus*, differing, however, in the shape of the lower plates on each side, which give more the appearance of a volute shell than of a bivalve. The total length of the head and body is about two inches.

This is a species of which I received a single specimen in a large collection from South Illinois, and mentioned under *I. impressus* in my monograph. It appears to be rare in the Western States, but very plenty in Texas.

On two New Minerals from Chester Co., Penn.

BY ISAAC LEA.

On a visit last summer to the well known *Corundum* locality near Unionville, Chester Co., my attention was attracted to an adhering fibrous mass, on the side of a large piece of *Corundum* on the farm of Mr. John Lesley, Jr. This was evidently different from any mineral accompanying *Corundum* which I had ever seen; and the application of my chisel showed at once that it had no outward characteristic of that exceedingly hard mineral. On the contrary, the edge of the instrument easily penetrated it, but at the same time it was tough and adhered so closely to the side of the mass of *Corundum* that it was with great difficulty I got quite a large piece off without breaking it up. Subsequently I took my friend Mr. Jefferis to the spot, and we obtained the remaining portion. On the careful examination of other masses of *Corundum* in possession of Mr. Lesley we could find no more of it. We found, however, pieces of a soft mineral which had a lamellar structure, and which I think will prove to be the same substance when they shall both be analysed. Believing that these are varieties of the same mineral, and that it has heretofore not been observed, I propose to call it *Lesleyite*, after the proprietor of the farm where it was found.

On some of the masses of *Corundum* we found very fine large lamellar crystals of *Emerylite*, some of the cleavage laminæ of which were one to two inches long and more than an inch broad. Some of these crystals exhibited well defined hexagonal prismatic sides. I believe no such fine specimens of *Emerylite* have been found elsewhere. In a few cases there were beautifully decremented crystals. In some of the cleavage plates may be observed irregular red spots, which under the microscope are transparent and of a bright color, but they present no regular crystalline form and are, no doubt, composed of one of the oxides of iron. When thin laminæ were subjected to the polaroscope the red color was unusually brilliant.

Connected with these crystals of *Emerylite* and passing into and through them, are dark green hexagonal, translucent *Tourmalines*, in prisms often an inch long, some of them being one-tenth of an inch thick. There is also much black *Tourmaline* connected with the *Corundum*.

The most important and rarest mineral of this locality is, however, *Diaspore* (Dihydrate of Alumina.) This I found in connexion with the large cleavage plates of *Emerylite* which surrounded the crystals of *Diaspore*, imbedding them in the mass. Some of the *Diaspore* was in lamellated masses of two to three inches and often of adamantine brilliancy. Some of the crystals of *Diaspore* are of a pure opaque white, while others are of a fawn color inclining to topaz

[April,

color. Others again are greenish and splendent. The prisms are hexagonal with four terminal planes, somewhat like the figure in Dana's Mineralogy. The largest I found is imperfect and measures in length an inch, and in breadth three-fourths of an inch. The finest and most perfect one is eleven-twentieths of an inch long and five-twentieths thick, being well terminated at both ends with four planes. Two small ones, about three-tenths of an inch long, are terminated also at both ends with four planes. These as well as some other crystals present very closely the color and appearance of crystals of *Topaz*. One of the crystals of *Diaspore* had a crystal of transparent green *Tourmaline* passing through the middle of the prism and the whole was enveloped by lamellar crystals of pearly *Emerylite*, showing that the *Tourmaline* was first crystallized, then the *Diaspore* and lastly the *Emerylite*. Mr. Jefferis also obtained some fine specimens.

Another species of mineral, which I believe heretofore unnoticed, belongs to the *Mica* Family. It is found only imbedded in the masses of *Lesleyite*. It has a gray metallic color resembling *Zinc*. It is translucent only in thin cleavage laminæ. I propose to call this *Pattersonite*, after Mr. Johnson Patterson, the owner of the adjoining farm, and where the large masses of *Corundum* were first found, one of which weighed four thousand pounds. Mr. Patterson has always most liberally promoted the objects of Mineralogists who have visited him in search of minerals, and it is due to Mr. Lesley to say the same of him.

Lesleyite. Fibrous or lamellar, sometimes inclining to massive. Color whitish passing into reddish. Hardness about three. Streak white. Before the blowpipe parts with its water and becomes opaque white. Does not fuse with borax. Does not dissolve in muriatic acid. Under the microscope it presents no observable characteristics. Its gravity is greater than that of quartz. There is a disposition in the crystalline fibrous structure to diverge from a central point to be stellate, and in one crystal before me the radiating fibres are nearly four inches long.

Pattersonite. Basal cleavage imperfect, rarely if ever presenting an hexagonal prism, but disposed to present triangular plates, which joining make a sub-tetrahedral mass. The laminæ are not flexible and but slightly translucent. The color is metallic, bluish gray, resembling *Zinc*. The streak is grayish. Before the blowpipe parts with its water, but does not exfoliate like *Jefferisite*, nor does it intumescence like *Cryophyllite* and *Lepidomelane*, both of which fuse easily. With borax melts into a black bead. Does not dissolve in muriatic acid. Hardness about two. Under the microscope, with a power of one hundred diameters, many imperfect black plates may be observed, some of which are hexagonal, and they are probably one of the oxides of iron, *Göthite*?

This mineral may easily be distinguished from *Muscovite* by its crystalline form, by its color and by its opacity. From *Chinochlore* by its lighter color, its form of crystals, its transparency and its want of elasticity of laminæ. From *Cryophyllite* by its lighter color and its want of easy fusibility. From *Lepidomelane* by its lighter color, its want of easy fusibility, its crystalline form, &c.

A third study of the ICTERIDÆ.

BY JOHN CASSIN.

3. Sub-family ICTERINÆ.

Having for examination one of the most extensive collections of the birds of this group ever got together, and which includes a large number of specimens in young and immature plumage, as well as adults, with the sexes carefully marked, I have given short descriptions of all the species, and the various plumages of females and young, so far as they can be clearly determined. Of such species as I have not specimens, but of which I have no reason to doubt the validity, I have copied the original descriptions.

1867.]

This large and comprehensive series is composed essentially of the collection of the Philadelphia Academy, the fine and in fact extraordinary collection of the Smithsonian Institution, placed at my disposal with the usual generosity and true scientific spirit of that great Institution by Professor Joseph Henry, its accomplished Secretary, and the fine collection of my friend, that distinguished ornithologist, Mr. George N. Lawrence, of New York. The collection of the Philadelphia Academy contains nearly all the species mentioned in this memoir, mainly derived from the Massena collection, but the labels indicating locality are not always sufficiently explicit,—in which respect, however, those of the Smithsonian Institution and of Mr. Lawrence are generally entirely authentic and satisfactory.

I. Genus *ICTERUS*, Brisson.

Genus *Icterus*, Briss. Orn., ii. p. 85 (1760),

1. *Icterus*.

1. *ICTERUS VULGARIS*, Daudin.

Icterus vulgaris, Daud. Traite d'Orn. ii. p. 340 (1800).

Oriolus Icterus, Linn., Syst. Nat. i. p. 161 (1766).

Coracias Xanthornus, Scop., Ann. Hist. Nat. i. p. 39 (1768); not *C. Xanthornus*, Linn., Syst. Nat. i. p. 108 (1758).

Aud. B. of Am., oct. ed., vii. pl. 499. Buff. Pl. Enl. 532. Catesby Car. App. pl. 5.

Large; plumage of the throat and neck in front elongated, linear and pointed; bill nearly straight or slightly curved. A naked space behind the eye. Wing rather long, third and fourth quills longest; tail rather long, feet robust. Adult ♂. Head black; back, wings and tail black; shoulders yellow, greater coverts white, and edges of shorter quills white, forming a longitudinal band of white on the wing. Neck behind, rump, and entire under parts usually rich orange yellow, frequently paler yellow, and inclining to lemon or sulphur yellow. Bill dark bluish-black, base of under mandible light blue, frequently nearly white; legs bluish-brown. Total length about $9\frac{1}{2}$ to 10 inches; wing $4\frac{1}{2}$ to 5, tail 4 to $4\frac{1}{2}$ inches. Younger. Like the adult, but with the black plumage tinged with brown. Quills dark brown, under parts dull gamboge-yellow. Total length about 9 inches.

Hab.—Northern South America, Venezuela, Guiana, Rio Negro, northern Brazil, Jamaica? southern United States? Spec. in Mus. Acad., Philada., and Mus. Smiths., Washington.

Easily recognized by its lengthened beard-like feathers on the throat and neck, its large size, and wide stripe of white through the wing longitudinally from the yellow of the shoulder to the end of the secondary quills. The next species has, however, all these characters, and is probably not distinct. I have only seen this species from Northern South America, though one specimen in the Smiths. Mus. is undoubtedly from Jamaica; but this bird is so common in cages that almost any locality is possible!

2. *ICTERUS LONGIROSTRIS*, (Vieillot).

Agelaius longirostris, Vieill. Nouv. Dict. xxxiv. p. 547 (1819).

Icterus longirostris, (Vieill.) Bonap. Consp. Av. i. p. 435.

Hab.—Northern South America; "Carthagera, New Grenada" (Verreaux). Spec. in Mus. Acad. Philada., and Mus. Smiths. Washington.

This species, if such it is, may be distinguished from the preceding by its more slender and rather longer bill, and the specimens that I have seen are a pale lemon-yellow, instead of the usual orange-yellow of *I. vulgaris*; but it has the same description of lengthened and linear feathers on the neck in front, and the longitudinal band of white on the wing. In this bird the black of the head perhaps extends downwards on the neck further than in the preceding, but the general distribution of colors is very nearly the same. The character indicated by Bonaparte as above, "*sed cervice nigra*," I fail to recognize. It is a species of but very imperfect respectability.

One specimen in the Smithsonian Mus., labelled as this bird in the handwriting of that excellent ornithologist, Jules Verreaux, is from Carthagera, New Grenada; others, in the Academy Mus., are without labels indicating

[April,

locality. This bird and the preceding are not uncommon in the cities of the United States on the Atlantic seaboard, as cage-birds.

3. *ICTERUS AURANTIUS* (Hahn.)

Xanthornus aurantius, Hahn, Voeg. pt. vi. p. 1 (1820).

"*Xanthornus aurantius*, Wagler," Hahn, as above.

Oriolus Jamaicæ, Gm. Syst. Nat. i. p. 391 (1788).

Jamaicæ Brasiliensis, Marcg. et Piso, Hist. Nat. Brasil, p. 198 (1648).

Hahn, Voeg. vi. pl. 1. Prevost, Ois. Exot. pl. 70.

Easily distinguished from the preceding by the feathers of the throat and neck being somewhat lengthened only, but of the usual form (not linear nor pointed, as in the preceding). Greater wing coverts black, a large triangular spot of white on the wing (not a long wide stripe, as in the preceding). Naked space behind the eye, small.

Large, bill nearly straight, pointed; wing rather long, third, fourth and fifth quills longest; tail long; feet robust. Head, back, wings and tail black, shoulders orange-yellow, wing with a large triangular spot of white. Neck behind, rump, and entire under parts rich orange-yellow. Bill bluish-black, lighter at base of under mandible; legs dark brown. Total length about 10 inches; wing $4\frac{1}{2}$, tail $4\frac{1}{2}$ to $4\frac{3}{4}$ inches. Adult male. Female rather smaller, but similar in colors.

Hab.—Brazil; Bahia; Ceará. Spec. in Mus. Acad. Philada., and Mus. Smiths. Washington.

This species can readily be distinguished from *I. vulgaris*, with which it has been frequently confounded, by the absence of the long beard-like feathers of the throat which characterize the former bird, and other strong characters.

The fine orange color prevailing in this group of birds attains a maximum in this beautiful species, and seems especially rich and inclining to brilliant reddish in specimens from Northern Brazil. This bird and *I. gularis* are the largest of this genus, both being rather larger than *I. vulgaris*.

The proper name, by right of priority, for this species, is undoubtedly *Jamaicæ* of Gmelin, which seems to have been adopted from Marcgrave and Piso, as above. This name bears no relation nor intimation whatever to the island of Jamaica, but is apparently an attempt to Latinize the native name "*Jamac*." It is, however, too readily to be misunderstood, and on that account I do not regard its adoption as expedient, especially as I have *I. vulgaris* undoubtedly from Jamaica. Numerous specimens in the Acad. Mus. and in Smiths. Mus., from Brazil. The finest plumage, and apparently most perfectly adult, are from Ceará, Northern Brazil.

2. *Eupsar.*

4. *ICTERUS CROCONOTUS* (Wagler.)

Paracoliis croconotus, Wagl. Isis, 1829, p. 757.

Dumont, Dict. Sci. Nat. Atlas Ois. pl. 50, fig. 1. Guerin. Icon. Reg. An. Ois. pl. 20, fig. 1.

Large, with the front, face and throat only black (not the entire head, as in the preceding three species). Bill nearly straight, and rather short, a naked space behind the eye; wing moderate; tail rather long; legs stout. Adult ♂. Head above, and entire body above and below rich orange-yellow, tinged with red, especially on the top of the head and neck behind. Front and wide space on the throat, and sides of the head enclosing the eyes, shining black. Wings and tail black, shoulders orange-yellow; a triangular spot on the wing, white, scapulars yellow, tipped with black, under wing coverts fine chrome yellow. In some specimens there are a few black feathers on the back. Bill bluish-brown, lighter at base of under mandible. Total length about $9\frac{1}{2}$ inches; wing $4\frac{1}{4}$, tail $4\frac{1}{4}$ inches. Female. Like the male, but smaller, and yellow plumage frequently tinged with dull gamboge yellow. Total length about $8\frac{1}{4}$ inches. In some specimens of this species the feathers of the throat and neck in front are somewhat elongated and linear (as in *I. vulgaris*).

Hab.—Brazil; Bolivia; "head waters of the river Huallaga, Peru." Spec. in Mus. Acad. Philada., and Mus. Smiths. Inst. Washington.

This splendid species may be regarded as rivalling the preceding (*I. aurantius*), and is another beautiful bird. Numerous specimens in the Smiths. Mus. are from the Rio Parana, Brazil, and other localities in that country, from Bolivia, and in a fine collection made by Mr. Walter S. Church on the river Huallaga, Peru, as above. The Acad. specimens are from Brazil; specimens from Capt. Page's expedition to the Rio Parana, and labelled "Brazil," are the smallest. The figures cited above are sufficiently good for the easy recognition of this fine species, which has often been confounded with the preceding.

1867.]

5. *ICTERUS PECTORALIS* (Wagler).

Psarocolius pectoralis, Wagl. Isis, 1829, p. 755.

Icterus guttulatus, Lafres. Mag. Zool. 1844, p. 1.

Mag. Zool. 1844, pl. 52. Des Murs, Icon. Orn. pl. 10.

Adult. About the size of the preceding, *I. croconotus*. Breast spotted with black, shorter quills widely edged externally with white, back black. Head above, sides of neck, rump, and entire under parts, orange-yellow, deepest and reddish-orange on the head. Throat, lores, back, wings and tail black. Base of tail pale yellow; shafts of tail feathers (at base) white; bill bluish, lighter at base of lower mandible; legs light colored (in skins). Total length about $8\frac{3}{4}$ to 9 inches; wing 4 to $4\frac{1}{4}$, tail 4 to $4\frac{1}{4}$ inches.

Younger. Tail olive-green, quills dull brown; black plumage of the back edged with greenish.

Hab.—Central America; Nicaragua; Costa Rica. Spec. in Mus. Acad. Philada., and Smiths. Mus. Washington.

Easily recognized by its spotted breast, and well represented in the plates cited above. Specimens in the Acad. Mus., Philada., from San Juan de Nicaragua and Coban, Vera Paz, and in the Smiths. Mus., Washington, from Nicaragua and Costa Rica. A very fine, large species, apparently abundant in those countries. The edging of the shorter quills forms a long triangular spot of white in the terminal half of the wing, and there is a smaller spot of white near the base of the first primaries. Specimens from Nicaragua are the largest.

6. *ICTERUS PUSTULATUS* (Wagler).

Psarocolius pustulatus, Wagl. Isis, 1829, p. 757.

Pendulinus Californicus, Less. Rev. Zool. 1844, p. 436. Oeuv. Buff. Supp. vii. p. 333.

Adult ♂. Smaller. Back with longitudinal ovate spots of black, detached, isolated, and frequently not numerous in the adult, but larger, confluent, and inclining to form longitudinal stripes of black on the back in the younger or adolescent male. Head and body above and below orange-yellow, frequently deep reddish-orange on the head and breast. Throat, lores, wings and tail black. Shoulders yellow, medial coverts of the wing white, forming a wide transverse or diagonal band on the wing; all the quills, except the first, widely edged with white; tail black, tipped with white and pale yellow at base, shafts white (at base of tail). Bill bluish, paler at base of lower mandible; legs light bluish-grey (in skins). Total length about $7\frac{1}{2}$ to 8 inches; wing $3\frac{1}{4}$ to 4, tail $3\frac{1}{2}$ to $3\frac{3}{4}$ inches.

♀. Entire upper parts yellowish olive, tinged with ashy on the back, and with ovate brownish-black spots (on the back). Under parts greenish-yellow, throat black, wings ashy brown, all the coverts and quills edged with white; tail olive green. Total length about 7 inches. Young ♂. Like the female, but with the brilliant reddish-orange appearing on the head in front and sides of the neck; white edgings of the quills and coverts more conspicuous.

Hab.—Mexico (Mazatlan). Spec. in Mus. Acad. Philada., and Mus. Smiths. Washington.

Numerous specimens in the Acad. Mus., Philada., labelled as from Mexico, and in the Smiths. Mus.; also from Mexico, the latter being mainly in the large and valuable collections of Col. A. J. Grayson and Capt. John Xantus, from Mazatlan and other localities in Western Mexico. In the adolescent and nearly mature plumage this bird is *Pendulinus Californicus*, Lesson, as above.

This is a very handsome small species, not difficult to recognize by the ovate longitudinal spots of the back (under nomen, *pustulatus*), and the deep reddish-orange (or orange-red) of the head and breast. It appears to be an abundant species of Western Mexico. This species does not appear to have been figured by any author.

7. *ICTERUS GRAYSONII*, nobis.

Large; resembling the preceding (*I. pustulatus*), but much larger, and with very few or no spots on the back. About the size of *I. pularia*, but not resembling that species. Bill nearly straight, gradually tapering, and not unusually thick at base; wing moderate, fourth quill longest; tertiaries rather long; tail moderate or rather long; legs and feet moderate.

Adult ♂. Entire plumage of the head and body orange-yellow, rather lighter and duller on the back, deeper, and inclining to reddish-orange on the head in front, sides of the neck and breast. Back with a few small, partially concealed spots of black. Lores, throat, wings and tail black. Shoulders yellow, greater coverts, and all the quills except the first, widely edged with white on their outer edges. Scapulars yellow, edged externally with black. Greater wing coverts and primaries edged also with white on their inner edges. Tail black, tipped with ashy white, and with its basal one-fourth yellow, where also the shafts of the feathers are white. Bill and legs bluish, the latter darker. Total length about $9\frac{1}{4}$ inches; wing $4\frac{1}{4}$, tail $3\frac{1}{4}$ inches.

[April,

Adult ♀? Smaller; total length 8 inches; entire upper parts olive-green, with obscure darker shades on the back; under parts greenish-yellow. Throat black, wings dark brown, coverts and quills edged with white. Tail yellowish olive-green, obscurely tipped with ashy white.

Hab.—Tres Marias Islands, western coast of Mexico. Discovered by Col. A. J. Grayson, of Mazatlan, Mexico. Spec. in Mus. Smiths. Inst. Washington.

Single specimens only, labelled as male and female, are in the Smiths. Mus. This fine species is nearly as large as the well known *I. gularis* of Mexico and Nicaragua, which, however, it does not resemble, nor does it resemble intimately any other species. It bears a general resemblance only to *I. pustulatus*, but is much larger, and has the back nearly uniform with other upper parts, a few small black spots only being apparent.

This handsome bird is gratefully dedicated to its discoverer, Col. A. J. Grayson, a gentleman whose indefatigable exertions have greatly elucidated the zoology of Western Mexico, and whose isolated position only prevents him from attaining high reputation as a naturalist. As yet, Col. Grayson has only found this bird in the Tres Marias Islands, in the Pacific Ocean, nearly west of San Blas, and about one hundred miles southwest of Mazatlan, Mexico.

8. *ICTERUS SCLATERI*, nobis.

"*Icterus mentalis*, Less.," Sclat. Cat. Am. Birds, p. 134.

Resembling *I. pustulatus*, but rather larger, and with the back black and less white on the wings. Plain and rather pale orange-yellow (not reddish-yellow, as in *I. pustulatus*). Also somewhat resembles *I. gularis*, but much smaller.

Adult ♂. Head, rump and entire under parts plain but rich orange-yellow; throat, lores, back, wings and tail black. The plumage of the back white at base, subterminally yellow, and tipped with black; the yellow appearing on the edges of the feathers. Scapulars white and yellow, and widely tipped with black. Shoulders yellow, the longest smaller coverts tipped with white, which forms a diagonal narrow band; greater coverts black, narrowly tipped with white on their outer webs; quills edged with white, narrow on the primaries, wide on the shorter tertiaries; a large spot of white on the wing at the base of the primaries. Tail black, yellow at base, and narrowly tipped with grayish-white; bill bluish, lighter at the base of the under mandible; legs bluish-gray. Total length about 8 inches; wing $4\frac{1}{2}$, tail $4\frac{1}{4}$ inches.

Younger ♂ or ♀? Entire plumage of the head and body plain dull lemon-yellow, tinged with green on the body above, and with numerous large spots of brownish-black on the back. Throat black, wings dull brown, greater coverts and quills edged with grayish-white, tail olive-green. Total length $7\frac{1}{2}$ inches; wing $3\frac{3}{4}$, tail $3\frac{3}{4}$ inches. The specimen now described is labelled as a female by the collector.

Hab.—Nicaragua; "San Juan;" "Pres Grenada;" Guatemala; "San Geronimio." Spec. in Mus. Acad. Philada., and Mus. Smiths. Washington.

This is the species alluded to by Dr. Sclater, Cat. Am. Birds, p. 134, and perhaps by Dr. Cabanis, Mus. Hein. i. p. 185, as *Icterus mentalis*, Lesson, which it is not, however, nor very nearly resembling it, either by that name or its other name, which is *Icterus gularis*, Wagler. It is a very handsome small species, common in collections from Nicaragua and Guatemala, of which numerous specimens are in the Acad. Mus., certainly from the vicinity of San Juan, and in the Smiths. Mus. from various localities in both countries. Specimens in Smiths. Mus., from Mr. Salvin's collections in Guatemala, are labelled "*Icterus mentalis*" by him, and this is therefore undoubtedly the bird alluded to by him and Dr. Sclater under that name as above, and elsewhere.

3. *Andriopar.*

9. *ICTERUS GULARIS* (Wagler).

Psarocolius gularis, Wagl. Isis, 1829, p. 754.

Icterus mentalis, Less. Cent. Zool. p. 111 (1830).

"*Cacicus mentalis*, Wagler, Isis," Less., as above.

Des Murs, Icon. Orn. pl. 9. Lesson, Cent. Zool. pl. 41. Gervais, Atl. Zool. Orn. pl. 36.

Large; bill thick, strong, rather short, and abruptly tapering to a sharp point; wing moderate, third and fourth quills usually longest and nearly equal; tail moderate; legs rather strong; claws strong, curved.

Adult ♂. Back lustrous black. Head, rump, and entire under parts rich orange-yellow. Lores and throat black, united by a narrow band at the base of the under mandible. Back, wings and tail black, the last yellow at base; shoulders yellow, greater coverts black.

1867.]

tipped with white, primaries narrowly edged, tertiaries rather widely edged with white, in some specimens the tail is very narrowly tipped with grayish-white. Bill bluish or horn-color, lighter at the base of the under mandible; legs light brown. A small white triangular spot at base of primaries. Total length about $9\frac{1}{2}$ inches; wing $4\frac{1}{2}$, tail 4 inches.

Adult ♀. Generally like the male, but with the back and wing coverts yellowish olive-green; tail brownish-olive; throat black. Wings (and shoulders) grayish-brown, coverts and quills edged with grayish-white. Total length $9\frac{1}{2}$ inches.

Young ♂. Like the female, but with the black beginning to appear on the back and scapulars; tail brownish-black.

Hab.—Mexico; Nicaragua. Spec. in Mus. Acad. Philada., and Mus. Smiths. Inst. Washington.

Easily recognized by its large size, and thick, straight bill. This fine species is one of the largest and most robust of the group. Numerous specimens in the Smiths. Mus. from Mexico.—“Mirador, near Vera Cruz,” “Salvador,” “Barcio,” “San Jeronimo, Vera Paz,” and other localities, and in the Acad. Mus. from the city of Mexico, from San Juan de Nicaragua, and others labelled only “Mexico.”

Specimens of this bird from San Juan de Nicaragua, undoubtedly authentic in locality, are quite as large as others from Mexico. This species is certainly *Icterus mentalis*, Less., as above, upon the examination of the description of which it will be found that a large specimen is required, instead of smaller, as stated by eminent ornithologists. Well represented in Des Murs' plate, above cited; Lesson's plates are not entirely correct.

10. *ICTERUS XANTHORHUS* (Gmelin).

Oriolus Xanthornus, Gm. Syst. Nat. i. p. 391 (1788).

Xanthornus linnæi, Bonap. Consp. Av. i. p. 434 (1850).

Xanthornus nigrogularis, Hahn, Voeg. pt. v. p. 1 (1820)?

Briss. Orn. ii. pl. 11, fig. 2. Buff. Pl. Enl. 5. fig. 1. Shaw, Nat. Misc. vii pl. 243. Prevost, Ois. Exot. pl. 70. Hahn, Voeg. pt. v. pl. 1?

Smaller; entirely yellow, greenish on the back; throat, wings and tail black. Bill short, straight, thick at base; wing rather short, third and fourth quills longest; tail moderate; legs rather strong. Total length about 7 to $7\frac{1}{2}$ inches; wing $3\frac{1}{2}$, tail $3\frac{1}{2}$ to $3\frac{3}{4}$ inches.

Adult ♂. Entire head and body rather dark lemon-yellow, inclining to orange on the sides of the neck and breast, usually strongly tinged with greenish on the back, but sometimes slightly only. Lores and throat with a narrow connecting line at the base of the under mandible, black. Shoulders yellow, wings black, greater coverts tipped with white, primaries very narrowly edged, tertiaries more widely edged with white; a triangular spot of white at base of primaries. Tail black, pale yellow at base, and usually very slightly tipped with grayish-white; bill and feet bluish. Scapulars with large, partially concealed spots of brownish-black.

Adult ♀. Like the male, but with the entire upper parts strongly tinged with olive-green; yellow of the under parts duller and less inclined to orange on the breast. Wings dark brown; tail olive-green. About the size of the male. Young ♂. Like the female, but with the tail black.

Hab.—South America; Venezuela; Cayenne; Trinidad; Northern Brazil. Spec. in Mus. Acad. Philada., and Mus. Smiths. Inst. Washington.

An abundant and well known species, of which specimens are in all collections in this country. Varies in the shade of yellow, but easily recognized. The plates of Buffon and Prevost, as above given, are good representations of this species.

11. *ICTERUS AURATUS*, Bonaparte.

“*Icterus auratus*, Du Bus, Mus. Brux.” Bonap. Consp. Av. i. p. 435 (1850).

“*Icterus mexicanus*, Bonap. MSS.” J. Verreaux's label.

“*Xanthornus mexicanus*, Brisson,” Bonap. Compt. Rend. 1853, p. 835.

“*Xanthornus nigrogularis*, Hahn,” Bonap. as above.

Larger than the preceding (*I. Xanthornus*), but resembling it; colors nearly the same, but the yellow clearer, and with very little tinge of olive on the back in the adult; black of the throat longer and much wider. Bill short, thick; wing moderate, third and fourth quills longest; tail moderate.

Adult ♂. Head and body above and below rather dark lemon-yellow, inclining to orange on the sides of the neck and breast. Lores and throat, and narrow connecting line at base of lower mandible, black. Wing black, shoulders yellow, greater coverts tipped with white, primaries very narrowly edged, tertiaries more widely edged with white. Tail black, pale yellow at base; bill and legs bluish. Total length about $8\frac{1}{2}$ inches; wing 4, tail $3\frac{1}{2}$ inches.

Hab.—Mexico. Spec. in Mus. Smiths. Inst. Washington.

[April,

Resembles the preceding (*I. Xanthornus*), but much larger, and with the yellow of the plumage more clear and darker yellow, inclining to orange, and less tinged with green on the upper parts of the body. Specimens in the Smiths. Mus. are from Mexico. This is undoubtedly the bird alluded to by the Prince Bonaparte as *X. mexicanus* and *X. nigrogularis* in Compt. Rend., as above cited, and I regard it also as *I. auratus*, Bonap. Consp. Av. as above, which species is very probably alluded to in Compt. Rend. (1853, p. 835) as in the Museum at Brussels.

This bird resembles, in general characters, the immediately preceding, but is a distinct species. The most available characters for recognition are its larger size and clearer yellow color.

12. *ICTERUS MESOMELAS* (Wagler).

Psarocolius mesomelas, Wagl. Isis, 1829, p. 755.

Icterus atrigularis, Less. Cent. Zool. p. 73 (1830).

Oriolus musicus, Cabot, Jour. Nat. Hist. Soc. Boston. iv. p. 465 (1844).

Less. Cent. Zool. pl. 22. Gerv. Atl. Zool. Orn. pl. 35.

Lemon-yellow, outer feathers of the tail yellow, shorter quills edged with pale yellowish-white, forming a conspicuous longitudinal stripe on the wing. Bill thick, slightly curved, wing moderate, third and fourth quills longest; tail long, graduated.

Adult ♂. Back, wings and middle feathers of the tail black. Lores and throat, and a narrow frontal band, black. All other parts lemon or chrome-yellow, rather darker on the head. Shoulders yellow, outer feathers of the tail pale yellow, under wing coverts yellow. Shorter quills conspicuously edged with yellowish-white; primaries narrowly edged on their terminal half with grayish-white. Bill and feet bluish-black, the former light blue at base of under mandible. Total length about 9 inches; wing $3\frac{1}{2}$ to $3\frac{3}{4}$, tail $4\frac{1}{4}$ to $4\frac{1}{2}$ inches.

Female like the male, but rather smaller. Total length about $8\frac{1}{2}$ inches. Yellow plumage, slightly tinged with greenish on the rump and abdomen.

Younger. Black plumage of the back edged with yellowish-green; yellow plumage strongly tinged with dull green.

Hab.—Mexico; northern and central Guatemala; Yucatan. Spec. in Mus. Acad. Philada., and Mus. Smiths. Inst. Washington.

Much resembles the species next succeeding (*I. Salvinii*), but is smaller, and can easily be distinguished by the longitudinal line on the wing, formed by the edgings of the shorter quills. Numerous specimens are in the Smiths. Mus. from Cordova and Orizaba, Mexico, and from central and northern Guatemala. Specimens in the Acad. Mus. are labelled "Mexico." This species is sufficiently well given in the plates above cited for recognition, but the characteristic light yellow edgings of the shorter quills, which form a conspicuous narrow band, are not fully shown. This fine species seems to be abundant in Mexico, and extends its range into Yucatan and the northern and central districts of Guatemala, south of which it is replaced by the next succeeding larger species (*I. Salvinii*).

13. *ICTERUS SALVINII*, nobis.

Much resembling the preceding, but larger, and with the quills entirely black (no trace of the yellowish-white edgings of the shorter quills, which are conspicuous in the preceding species). Bill strong, somewhat curved; wing rather long, third, fourth and fifth quills longest and nearly equal; tail rather long, graduated feathers of the tail rather narrow; feet strong.

Adult ♂. Head, rump, and entire under parts of the body fine lemon or chrome-yellow, shoulders and middle coverts of the wing yellow. Wide space on the lores and throat black. Back, scapulars, wings, and middle feathers of the tail deep black, primaries very faintly edged with grayish-white in their terminal half (all other quills clear lustrous black). Bill dark bluish or horn-color; feet bluish; under wing coverts yellow. Total length about $9\frac{1}{2}$ to 10 inches; wing 4 to $4\frac{1}{4}$, tail $4\frac{1}{4}$ to $4\frac{1}{2}$ inches.

Younger. Like the adult, but with the black feathers of the back edged with dull green; quills dark brown, edged with dull greenish-white; yellow of the upper parts tinged with green. Total length about $9\frac{1}{4}$ inches.

Hab.—Costa Rica; "Turrialba;" "San Carlos" (Mr. J. Carmiol); Nicaragua; "Greytown" (Mr. Holland); New Grenada; "Atrato River" (Capt. N. Michler); "Bogota" (Mr. Lawrence); Venezuela. Spec. in Mus. Acad. Philada., in Mus. Smiths. Inst. Washington, and in coll. Mr. Lawrence, New York.

Very similar to the immediately preceding (*I. mesomelas*), but is larger, and has the wing entirely black or very narrowly edged on the primaries only, and inhabits more southern regions of Central America and northern South America.
1867.]

America. Numerous specimens in the Mus. Smiths. Inst. are from Greytown, Nicaragua, and various localities in Costa Rica. Specimens in Acad. Mus. are from Bogota, New Grenada, and from Venezuela, and are undoubtedly correct in locality.

This fine species is dedicated to Osbert Salvin, Esq., of London, a most accomplished ornithologist, and most liberal patron of the natural sciences.

14. *ICTERUS GRACE-ANNÆ*, nobis.

In a large and highly interesting collection made by the Hon. John Randolph Clay, while United States Minister to Peru, and now in the possession of the Philadelphia Academy, there is one specimen of a small species of this group which I cannot identify from any figure or description. It is a small thick-billed species, about the size of *I. Xanthornus*, but with colors much resembling those of *I. mesomelas*; easily distinguished, though, from the latter, by its smaller size, and by having the tail entirely black and a very conspicuous, longitudinal spot of white in the middle third of its wing. It is very probably the bird alluded to by the Prince Bonaparte under the head of *Xanthornus mesomelas*, Consp. Av. i. p. 434, "var. ex Peru, Minor. An species?" It is a quite distinct and strongly marked species.

Adult. About the size of *I. Xanthornus*, but does not resemble it in colors; smaller than *I. mesomelas*, but similar to that species in general colors only, and easily distinguished in having a conspicuous longitudinal spot of white in the middle of the wing, and the tail entirely black. Head and neck above, rump and entire under parts (except the throat) lemon yellow; throat, lores, wings, tail, and a wide transverse band across the back, black. Shoulders and under wing coverts yellow, the greater wing coverts white, which color is partially concealed by the yellow of the shoulders. Outer edges of the shorter quills, in their middle third, white, forming a longitudinal spot about the middle of the wing. In the present specimen the outer feathers of the tail are edged and narrowly tipped with ashy-white. Bill and feet bluish-black, paler at the base of the under mandible.

Total length $7\frac{1}{4}$ inches; wing $3\frac{1}{4}$, tail $3\frac{3}{4}$ inches.

Hab.—Western South America; Peru? Spec. in Mus. Acad. Philada.

The fine collection of Mr. Clay, though mainly composed of birds of Peru, contained also some species of Ecuador and Bolivia, or hitherto only known as from those countries. The locality of the present species cannot therefore be given positively, but it is undoubtedly from western South America.

This handsome little bird I have named in honor of my highly esteemed friend, Miss Grace Anna Lewis, of this city: accomplished as a teacher of Natural History, conscientious in all social duties and relations, faithful in her friendships.

15. *ICTERUS GIRAUDII*, Cassin.

Icterus Giraudii, Cass. Proc. Acad. Philada. 1847, p. 333.

Xanthornus chrysater, Less. Oeuv. Buff. Supp. vii. p. 332 (1847)?

Icterus melanopterus, Hartl. Rev. Zool. 1849, p. 275.

Jour. Acad. Philada. i. pl. 17 (quarto).

Resembling the three last preceding in colors, but with the back clear yellow, uniform with the other upper parts (not black, as in *I. mesomelas*, *I. Salvinii*, and *I. Grace-Annæ*). Bill nearly straight, conic, thick at base, and gradually pointed; wing rather long, third and fourth quills longest; tail moderate, graduated; feet moderate.

Adult ♂. Head and entire body above and below rich chrome or sulphur-yellow, with a tinge of orange on the under parts; shoulders and inferior coverts of the wing yellow. Front, lores, and wide space on the throat and neck, enclosing the eyes, black; wings and tail black. Scapulars yellow, tipped with black (wings clear lustrous black, with paler edgings only towards the ends of the primaries; tail clear black, back yellow, not black, as in the preceding three species). Bill dark bluish, or horn-color; legs bluish-gray. Total length about $8\frac{1}{2}$ inches; wing 4, tail $4\frac{1}{4}$ inches.

Younger. Entire upper parts tinged with dull greenish, under parts with dull orange or gamboge; wings brownish-black, quills narrowly edged with dull yellowish-green; tail dark brown; shoulders black or dark brown.

Young. Entire plumage dull greenish-yellow, black appearing on the throat, wings and tail dark brown, outer feathers of the tail with their shafts white. Total length about $7\frac{1}{2}$ inches.

Hab.—Southern Central America and northern South America; Mexico? Spec. in Mus. Acad. Philada. and Mus. Smiths. Inst. Washington.

This very handsome species is another of those in which the plumage is

[April,

mainly rich lemon, chrome, or sulphur-yellow, not orange, nor tinged with red, as in many others of this group. A fine large species, with the wings and tail clear shining black, the primaries only narrowly edged with grayish-white on their terminal half.

Numerous specimens in Smiths. Mus. from Central Guatemala, and from the Rio Atrato (Capt. Michler's Expedition). Specimens in Acad. Mus. from Guatemala, Panama (Mr. J. G. Bell, collected by himself), and Bogota, New Grenada. This bird is quite probably *X. chrysater*, Lesson, as above, which is described as from Mexico, but from which country I have not seen it.

4. *Ateleopsar*.

16. *ICTERUS MELANOCEPHALUS* (Wagler).

Pearocolius melanocephalus, Wagl. Isis, 1829, p. 756.

Icterus graduacauda, Less. Rev. Zool. 1839, p. 105.

Cassin, B. of Cal. and Texas, pl. 21.

Head black, wings and tail black (wings clear black, the quills in the adult without any edgings of white, and very narrow and obscure only in young plumage). Bill rather short, nearly straight, culmen somewhat flattened; wing moderate, third and fourth quills longest; tail rather long, graduated; legs strong.

Adult ♂. Head and neck black; body above and below sulphur-yellow, tinged with green on the back, and frequently on the entire upper parts of the body. Wings and tail clear black. Bill dark horn-color, base of under mandible blue, which is succeeded by a triangular spot of yellowish-white; legs dark brown. Total length 8 to 8½ inches; wing 3¾ to 4, tail 4 inches.

Younger. Upper parts of body yellowish-green, quills narrowly edged with grayish-white, bill blue at base. Younger? Upper parts dark olive-green, wings and tail brownish-black, shoulders green, quills narrowly edged with grayish-white, outer tail feathers dark yellowish-green, bill blue at base. Total length about 8 inches.

Hab.—Southern Mexico; Jalapa (D'Oca); Mirador (Sartorius); Orizaba (Sumichrast). Spec. in Mus. Acad. Philada., and Mus. Smiths. Washington.

This species and the next (*I. Audubonii*) form a peculiar group of the genus *Icterus*, if, indeed, they are not entitled to generic distinction. The structure presents peculiarities in this group, the bill being flattened slightly on the culmen, wings and tail long, and the colors of the plumage are quite peculiar.

Specimens in the Smiths. Mus. are exclusively from Mexico. This bird is smaller than the next succeeding, and appears to be quite distinct; though in plumage not quite mature, there are some light edgings of the shorter quills, as here described. In this nearly adult plumage it is described by Wagler, as cited above: "*remigibus extus strictis griseo-marginatis*." This plumage also is described by me in "Birds of California and Texas," p. 139, though the more fully adult is figured. In the next species the quills are edged with white in all ages. The name *melanocephalus* is pre-occupied by Hahn, as below, under *I. Parisorum*.

17. *ICTERUS AUDUBONII*, Giraud.

Icterus Audubonii, Gir. B. of Texas, p. 5 (1841).

Like the preceding, but larger, and with the shorter quills widely edged with white. Bill nearly straight, culmen flattened, third and fourth quills longest; tail rather long, graduated; legs strong.

Adult ♂. Head, wings and tail black, body above and below sulphur yellow, tinged with green on the back more or less strongly, according to age or season. Quills, especially the shorter tertiaries, edged externally with grayish-white; bill dark horn-color, base of under mandible bluish; legs dark brown.

Younger. Quills brownish-black, tail with the outer feathers dull green. Total length (adult) about 9½ inches; wing 4, tail 4 to 4½ inches.

Hab.—Northern Mexico; Tamaulipas; Nuevo Leon (Gen. Couch); Texas (Mr. J. H. Clark); New Mexico. Spec. in Mus. Acad. Philada., and Mus. Smiths. Washington.

Larger than the immediately preceding, but much resembling it, and with the colors nearly the same. In this species the shorter quills are edged conspicuously with white at all ages, in which respect it differs from the preceding, and it appears to inhabit exclusively Northern Mexico and the adjoining districts of the United States.

1867.]

PROCEEDINGS OF THE ACADEMY OF

5. *Cassiculoides*.

18. *ICTERUS PARISORUM*, Bonaparte.

Icterus Parisorum, Bonap. Proc. Zool. Soc. London, 1837, p. 110.

Icterus melanocephalus, Less. Rev. Zool. 1839, p. 105.

Icterus Scottii, Couch, Proc. Acad. Philada. 1854, p. 66.

Icterus melanocephalus, Hahn, Voeg. Am. pt. vi. p. 4 (1820)?

Hahn, Voeg. pt. vi. pl. 3? Baird, B. of N. A. pl. 61, fig. 1. Rept. U. S. and Mex. Bound. Surv. Birds, pl. 19, fig. 1.

Anterior half black, or head and neck, back and breast, black. Abdomen and rump yellow, the latter generally tinged with greenish. Wings black, the greater coverts widely tipped with white, shorter quills widely edged with white. Middle feathers of the tail black, with their bases yellow; other feathers of the tail with their basal two-thirds yellow, terminal one-third black. Bill dark horn-color, base of under mandible pale blue; legs bluish-brown. Bill straight, rather slender, pointed, culmen distinctly ridged; legs rather strong; wing long, third quill longest; tail moderate. Adult male. Total length about 7 to 8 inches; wing 4 to 4½, tail 3½ to 3¾ inches.

Younger ♂. Entire head and back dark brown; rump greenish-yellow, under parts of body dull pale yellow; tail olive-green; outer feathers greenish-yellow at base; wings dull brown, coverts tipped with white. Total length 7 inches.

Hab.—Mexico; Lower California (Capt. Xantus); Texas; New Mexico. Spec. in Mus. Acad. Philada., and Mus. Smiths. Washington.

This is another strange and peculiar form in the generic group *Icterus*, and belongs almost as properly to *Cassicus*. The colors, too, are quite peculiar, and approximate to the same group. It may be termed an analogue of *Cassiculus*, in the genus *Cassicus*, if not more nearly related, but I am by no means confident that this bird does not represent a peculiar generic division. Numerous specimens in Smiths. Mus. from Northern Mexico and Lower California. This is the bird, I suspect, attempted to be represented in Hahn's plate, above cited, but without success. It is, however, correctly and handsomely given in Prof. Baird's plates, as cited.

II. Genus *PENDULINUS*, Vieillot.

Genus *Pendulinus*, Vieill. Analyse, p. 33 (1816).

This group is composed of birds characterized by having more slender, lengthened, and weaker forms than in *Icterus*, with more slender, curved, and gradually tapering bills, and long tails, either rounded at the ends or graduated. It is, in my opinion, a distinct and strongly marked generic group, of which the species here given as *P. bonana* is perhaps to be regarded as typical. The type of the genus, according to Vieillot, is the North American *P. spurius*, but in this respect he is probably in error, that species being, very probably, one of the most aberrant. Fifteen species of this genus are in the Museum of the Philadelphia Academy and the Museum of the Smithsonian Institution, Washington. Three others given in the succeeding pages (*P. rufigaster*, *P. rufaxillus*, and *P. chilensis*) are not contained in either of the two collections mentioned. In this group, as in the preceding, I have given short descriptions of all the species of which I have any knowledge, and have copied the original descriptions of the three species to me unknown, above mentioned.

1. *Bananivorus*.

1. *PENDULINUS BONANA* (Linnæus).

Oriolus Bonana, Linn. Syst. Nat. i. p. 162 (1766).

Pendulinus bonana, Vieill. Nouv. Dict. v. p. 316 (1816).

Buff. Pl. Enl. 539, fig. 1.

Head, neck and breast dark chestnut, shoulders, rump and abdomen a paler shade of chestnut, lightest on the rump. Back, wings and tail black; under wing coverts pale chestnut; upper and under tail coverts frequently tipped with black. Bill dark horn-color, paler at base of under mandible; legs brown. Bill curved, slender; wing rather long, third quill longest; tail rather long, graduated. Adult ♂. Total length about 7½ inches; wing 3½, tail 3¼ inches. Female. Like the male, but smaller. Total length about 7 inches.

Hab.—West Indies; Martinique (Smiths. Mus.) Spec. in Mus. Acad. Philada., and Mus. Smiths. Washington.

[April,

Although having abundance of specimens before me in the Acad. Mus. and Smiths. Mus., I am not able to state the islands of the West Indies inhabited by this species, nor have I seen any other than the adult plumage. One specimen only in the Smiths. Mus. is undoubtedly from the island of Martinique, but all others now before me are either labelled "West Indies" or "Antilles." This is a quite peculiar, and, in adult plumage, an easily recognized species, but is probably allied to the immediately succeeding (*P. rufigaster*).

2. PENDULINUS RUFIGASTER, Vieillot.

Pendulinus rufigaster, Vieill. Nouv. Dict. v. p. 321 (1816).

"*Bananivorus rufigaster*, Bp. ex Vieill.," Bonap. Comp. Rend. 1853, p. 834.

"Cette espèce, que je crois nouvelle, a le ventre et les parties postérieures d'un roux ardent; le rest du plumage noir, ainsi que le bec et les pieds; taille du *carouge esclave* (*P. dominicensis*). Elle se trouve dans l'Amerique méridionale." Vieillot, as above.

"Nigro; capite, collo, pectoreque castaneis; uropygio, corpore subtus, tibiis, tectricibusque alarum minoribus et inferioribus, fulvis. Le *Troupiale enfumé* du Musée de Paris, rapporte de la Guadeloupe par M. Moreau de Jonnes, nommé par Vieillot, *Pendulinus rufigaster* et réuni à tort au *spurius*." Bonap. Compt. Rend., as above.

Hab.—Gaueloupe. Spec. in Paris Museum.

These are the original descriptions of a bird given as distinct from *P. bonapa* by Bonaparte, as above cited, but which I have not seen. It seems to be nearly related to that species, but may be an inhabitant of different islands, and, like others in this memoir, persistently presenting some clearly peculiar characters. On the faith of the description by Bonaparte, I give it as probably a species of respectability, and his indication of the locality is important. It is given doubtfully by that great naturalist in *Consp. Av.* (i. p. 432) as synonymous with *P. spurius* of North America, which I suppose is the *tort* to which he alludes.

3. PENDULINUS RUFAXILLUS, Bonaparte.

Pendulinus rufaxillus, Bonap. *Consp. Av.* i. p. 432 (1850).

"Ex Mexico. Nigerrimus; humeris cinnamomeo-castaneis; tectricibus alarum minoribus citrino-castaneis; cauda elongata; rostro elongato, acutissimo." Bonap., as above.

This species I have not seen. It seems to resemble in colors of plumage, at least, *Agelaius pyrrhopterus*, Vieill. (which is *Hyphantes pyrrhopterus* of this memoir), but that species was apparently known to the Prince Bonaparte, as he gave it a name (*Pendulinus periporphyrus*, Bonap. *Consp. Av.* i. p. 432.)

2. *Poliopsar*.

4. PENDULINUS WAGLERI (Sclater).

Icterus Wagleri, Sclat. Proc. Zool. Soc. London, 1857, p. 7.

Psarocolius flavigaster, Wagl. Isis, 1829, p. 756.

Pendulinus dominicensis, Bonap. *Consp. Av.* i. p. 432 (nec Linn.)

Baird, B. of N. A. pl. 61, fig. 2. Rept. U. S. and Mex. Bound. Surv., Birds, pl. 19, fig. 2.

Larger; head, neck and back black; shoulders, rump and abdomen orange-yellow; wings and tail black, upper and under tail coverts black. The black on the breast separated from the yellow of under parts of the body by a narrow band of chestnut, frequently obscure, but generally strongly marked. Under wing coverts yellow. Bill long, curved, bluish-black, lighter at base of under mandible; legs dark brown; wing rather long, third and fourth quills longest; tail long; legs rather short. Adult ♂. Total length about 9 inches; wing $4\frac{1}{4}$, tail $4\frac{1}{2}$ inches.

Young. Entire upper parts yellowish-green, inclining to clearer yellow on the head, and green on the back; throat black; sides of neck and under parts of body dull yellow; wings dark brown, coverts edged with dull white; shoulders greenish-yellow; tail with the middle feathers brownish-black, outer feathers yellowish-green. Total length about 8 inches.

Younger. Entire upper parts of head and body dull olive-green; under parts dull-pale greenish-yellow.

Hab.—Mexico; Guatemala; State of Coahuila, northern Mexico (Gen. Couch); Mazatlan (Col. Grayson); San Geronimo, Guatemala (Mr. O. Salvin). Spec. in Mus. Acad. Philada., and Mus. Smiths. Washington.

The under tail coverts being black, is a character to be remembered in com-
1867.]

paring this fine species with the next succeeding in this memoir (*P. prothemelas*), as the most immediately available character. It resembles and is nearly allied to that species. Numerous specimens in Acad. Mus. and Smiths. Mus. from Mexico and Guatemala, in both of which countries this handsome bird seems to be abundant.

5. *PENDULINUS PROTHEMELAS* (Strickland).

Icterus prothemelas, Strickl. Jard. Contr. Orn. 1850, p. 120.

Pendulinus Lessoni, Bonap. Cons. Av. i. p. 432 (1850).

Jard. Contr. Orn. 1850, pl. 62.

Resembling the preceding (*I. Wagleri*), but smaller, and with the under tail coverts yellow, uniform with the abdomen. Head, neck and back black; shoulders, rump, abdomen and under tail coverts yellow; a transverse band of chestnut separating the black from the yellow on the breast, frequently strongly marked, but often obscure or imperfect. Wings and tail clear black, longer upper tail coverts black, under wing coverts yellow. Bill shorter than in the preceding, curved, rather thick at base; wing moderate, third quill longest; tail long. Bill bluish-black, pale blue at base of under mandible; legs brownish-black. (No white marks nor spots in wings nor tail.) Adult ♂. Total length about 8 to 8½ inches; wing 3½, tail 3¼ to 3¾ inches.

Young. Singularly resembling in colors *I. melanocephalus* and *Auduboni*. Head and neck in front black; entire upper parts of body greenish-yellow, shoulders and abdomen yellow. Wings and tail black. Total length 7½ to 8 inches. Adolescent, with the black of the adult beginning to appear on the back and scapulars, and presenting a mottled yellowish-green and black, in which plumage this bird is *P. Lessoni*, Bonap., as above.

Hub.—Guatemala; Costa Rica; southern Mexico. Spec. in Mus. Acad. Philada., and Mus. Smiths. Washington.

This bird resembles the preceding (*P. Wagleri*), but is smaller, and has the under tail coverts yellow instead of black. It is undoubtedly *P. Lessoni* of Bonaparte, as suggested by that distinguished author in Compt. Rend. 1853, p. 834. Numerous specimens in the Smiths. Mus. are from countries above given; the type described by Strickland in the Acad. Mus. is labelled "Central America."

The young of this bird bears a strong resemblance in colors only to the adult *Icterus melanocephalus* and *I. Auduboni*. Specimens in this young plumage, and others with the black color beginning to appear on the back, are in Smiths. Mus. Indifferently figured by Strickland, as above, but better than Hahn's figures, and recognizable with some exertion.

6. *PENDULINUS MACULI-ALATUS* (Cassin).

Icterus maculi-alatus, Cass. Proc. Acad. Philada. 1847, p. 332.

Jour. Acad. Philada., quarto, i. pl. 16, fig. 1.

Resembling the two species immediately preceding, but smaller than either, and having the greater wing coverts with ovate spots of white at their tips. Primaries narrowly edged with white in their terminal third. Head, neck and back, black; shoulders, lower part of back, rump and under parts orange-yellow; under wing coverts yellow. Bill bluish-black, pale blue at base of under mandible; legs dark brown. Bill moderate, curved, rather thick at base; wing rather long, third and fourth quills longest; tail rather long, somewhat graduated. Adult. Total length about 7½ inches; wing 3¾, tail 3½ inches.

Hub.—Guatemala; "Vera Paz" (Mus. Massena). Spec. in Mus. Acad. Philada.

The type of this species, described by me as above, remains the only specimen that I have seen, though it has been obtained at various localities in Guatemala by late European naturalists and travellers. This species is of the same sub-group as the two immediately preceding (*P. Wagleri* and *P. prothemelas*), but is easily distinguished by the white spots on the wing coverts, which are peculiar, and a strong character. The type of this species in the Acad. Mus., from the Massena collection, is labelled "Coban, Vera Paz," which latter was printed erroneously "Vera Cruz" in my original description.

3. *Melanopar.*

7. *PENDULINUS CHRYSOCEPHALUS* (Linnæus).

Oriolus chrysocephalus, Linn. Syst. Nat. i. p. 164 (1766).

Gracula chrysoptera, Merrem Beytr. Gesch. Voeg. (1784).

Briss. Orn. vi. Supp. pl. 2. Merr. Beytr. pl. 3. Vieill. Gal. i. pl. 86. Spix. Av. Bras. i. pl. 67.

[April,

Adult ♂. Black; head above, rump, shoulders and tibiae bright yellow. Longer upper coverts of the tail black; under tail coverts frequently with a few yellow feathers. Yellow of the head above and tibiae frequently mixed with black. Bill curved, slender, brownish-black; wing rather long, third and fourth quills longest; tail long, graduated; legs rather short, brownish-black. Total length about 9 inches; wing 4 to 4½, tail 4¼ inches.

Younger. Dull dark brown; head, above, shoulders, rump and tibiae dull yellow.

Variety? Same species? Like the preceding, but with the yellow on the head more restricted, and *rump black*, uniform with other upper parts of body.

Hab.—Northern South America; Guiana; Brazil. Spec. in Mus. Acad. Philada., and Mus. Smiths. Washington.

An easily recognized and well known species, apparently abundant in the northern countries of South America. One specimen in the Acad. Mus., from the Massena collection, differs from all others now under examination in having the lower part of the back and rump black, uniform with other upper parts of the body, but is not in fully adult plumage. Specimens in Acad. Mus. are from "Cayenne," others in the Smiths. Mus. are from Demerara, and one in the collection of Mr. Lawrence is probably from Ecuador. Wagler, in Syst. Av., seems to describe the black-backed variety above mentioned, exclusively, but Brisson describes the more usual plumage, as above given.

8. *PENDULINUS CAYANENSIS* (Linnæus).

Oriolus cayanensis, Linn. Syst. Nat. i. p. 163 (1766).

"*Icterus flaviscapularis*, Lesson."

Agelaius chrysopterus, Vieill. Nouv. Dict., xxxiv. p. 539 (1819).

Briss. Orn. ii. pl. 9, fig. 2. Buff. Pl. Enl. 535, fig. 2? Swains. Zool. Ill. i. pl. 22.

Bill long, slender, curved; tail long, wide, graduated; wing rather long, second and third quills longest; legs moderate or rather short; tibiae black. Entire plumage deep black, except the shoulders, which are yellow. Under wing coverts usually mixed yellow and black. Bill brownish black, legs brown. Adult. Total length about 9 inches, wing 4, tail 4 to 4¼ inches.

Hab.—Northern South America, Cayenne, Northern Brazil? Spec. in Mus. Acad., Philadelphia.

This is another of the species of which I can give no precise nor well determined locality from specimens before me. It is not a common species in American collections, and seems to have been confounded with several others which it resembles only in its black plumage, but to which, in fact (except *P. tibialis*), it is not very nearly related. In determining this species, and distinguishing it from others which resemble it, the long and curved bill, and long, graduated tail are available characters. Specimens in the Acad. Mus. are from the Massena collection. Much resembling the next species, *P. tibialis*, but seems to differ in being rather larger, the bill longer and more curved, and the tibiae black (which are yellow in *P. tibialis*).

9. *PENDULINUS TIBIALIS* (Swainson).

Icterus tibialis, Swains. Cab. Cy. p. 302 (1838).

"*Xanthornus femoralis*." Label on Spec. from Imp. Mus. Rio de Janeiro.

Xanthornus flavaxilla, Hahn, Voeg. pt. vi. p. 1 (1820)?

Hahn Voeg. pt. vi. pl. 2?

Rather smaller than the preceding, bill shorter, tibiae yellow. Bill slightly curved or nearly straight, slender; wing rather long, third quill longest; tail long, wide, graduated; legs rather short. Entire plumage black, except the shoulders and tibiae, which are yellow; under wing coverts and axillaries yellow (perhaps not so generally mixed with black as in the preceding). Tibiae frequently mixed yellow and black. Bill and legs brownish black. Adult ♂. Total length about 8½ inches, wing 3¾ to 4, tail 4 inches. Adult ♀. Like the male but smaller, total length about 8 inches.

Hab.—Brazil, Bahia, Ceará. Spec. in Mus. Acad., Philada., and Mus. Smiths. Inst., Washington.

Distinguished from *P. cayanensis* by its yellow tibiae, in addition to which this bird seems to be rather smaller and has the bill shorter and less curved. It is not entirely easy, however, to fully determine the specific value of this bird, as specimens constantly occur in collections which have the tibiae mixed yellow and black and, although usually with shorter bills than the adult *P. cayanensis*, are in other respects about as much that species as the present. Fine 1867.]

specimens in the Smiths. Mus., from Ceará, Northern Brazil, have the *tibie* clear yellow. Numerous specimens in the Smiths. Mus. and Acad. Mus. from various localities in Brazil. This bird is probably that described by Hahn, as above cited. It is commonly brought in Bahia collections.

10. *PENDULINUS CHILENSIS*, Reichenbach.

Xanthornus chilensis, Reich. Denks. Acad. Vienna, 1853, pt. ii., p. 130. Cab. Jour. 1855, p. 55.

"Zunächst *Xanth. cajennensis*, doch kleiner, der Schwweif viel kleiner, nicht stufenformig-kaum gerundet."

"Ziemlich häufig habe ich diesen schönen Vogel etwa 12 Stunden weit von Valparaiso in einer ebenen und etwas sunpfigen Gegend getroffen, an anderen Orten selten und bloss in vereinzelt Exemplaren."

Evidently a peculiar species, but which I have not seen, nor indeed any black species of this style from Western South America.

11. *PENDULINUS DOMINICENSIS* (Linnæus).

Oriolus dominicensis, Linn. Syst. Nat. i. p. 163 (1766).

Pendulinus flavigaster, Vieill. Nouv. Dict. v. p. 317 (1816).

Pendulinus viridis, Vieill. Nouv. Dict. v. p. 321 (1816)?

Briss. Orn. ii. pl. 12, fig. 3. Buff. Pl. Enl. 5, fig. 2.

Like the two preceding (*P. cayanensis* and *tibialis*) but smaller, and with the under tail coverts, sides of the abdomen and rump yellow (shoulders and *tibie* also yellow). All other parts of the plumage black. Middle of the abdomen black, uniform with the other plumage, but yellow on the sides (of the abdomen); under wing coverts and axillaries yellow. Bill and feet bluish black. Adult ♂. Total length about 8 to 8½ inches, wing 3½ to 3¾, tail 3¼ inches.

Young? Throat black, shoulders and rump greenish yellow; all other parts of the plumage dark olive green, strongly tinged with yellow on the under parts. Tibias greenish yellow. Resembles the young of *P. hypomelas*, of Cuba.

Hab.—St. Domingo or Hayti. Spec. in Mus. Acad., Philada., and Mus. Smiths. Inst., Washington.

Exclusively inhabiting the Island of St. Domingo. Resembles not only the two preceding, *P. cayanensis* and *P. tibialis*, but also the two next succeeding, *P. portoricensis* and *P. hypomelas*, from all of which it is readily distinguished by its under tail coverts and sides of the abdomen being yellow, in which respect and otherwise generally it is well represented by Buffon in Pl. Enl., as cited above. Specimens in the Smiths. Mus. and Acad. Mus. are certainly from the Island of St. Domingo. Those in the Smiths. Mus. are from the valuable collection of Mr. A. C. Younglove, made in the vicinity of Port au Prince.

12. *PENDULINUS PORTORICENSIS* (Bryant).

Icterus dominicensis, var. *portoricensis*, Bryant, Proc. Nat. Hist. Soc. Boston, 1866, p. 254.

Turdus ater, Gm. Syst. Nat. i. p. 830, (1788)?

Turdus jugularis, Lath. Ind. Orn. i. p. 351 (1790)?

Buff. Pl. Enl. 559?

Resembling *P. dominicensis*, but with the yellow smaller in space on the rump, and restricted to the tibias and under tail coverts on the under parts (no yellow on the sides of the abdomen, as in *P. dominicensis*); also resembles *P. hypomelas*, of Cuba, but the adult of that species has the under tail coverts black, and the young plumages are quite different. Bill slightly curved, rather straighter and thicker than in *P. dominicensis*; wing moderate, third quill slightly longest; tail moderate; legs rather short.

Adult ♂. Shoulders, rump, under tail coverts and tibias yellow, all other parts black. Under wing coverts yellow, bill black, legs brownish black, a few of the longer upper tail coverts black, and the longer under tail coverts frequently tipped with black. Total length about 8½ inches, wing 3¼ to 3¾, tail 3¼ inches.

Young. Upper parts of body dull yellowish or reddish olive green, under parts reddish yellow tinged with green on the abdomen, quills and tail yellowish green. Adolescent. Like the young in the plumage of the head and body, but with the tail black, and with the black beginning to appear at the base of the bill and on the back. (The young differs from that of *P. hypomelas* and also from that of *P. dominicensis*).

Hab.—Porto Rico. Spec. in Mus. Acad., Philada., and Mus. Smiths. Inst., Washington.

Numerous specimens of this species are in the Smiths. collection, exclusively from Porto Rico. Related to and resembling the preceding *P. dominicensis* but distinguishable without difficulty by the yellow color on the under parts being

[April,

restricted to the tibiae and under tail coverts. The young of this species is probably different entirely from that of *P. dominicensis*, and certainly from that of *P. hypomelas*, and resembles the figure in Pl. Enl. 559 in a greater degree than that of any other species known to me.

The extensive and valuable collections made in Porto Rico by Mr. Robert Swift and Mr. George Latimer, and presented by them to the Smithsonian Institution, contain all plumages of this species, as above described.

13. *PENDULINUS HYPOMELAS*, Bonaparte.

Pendulinus hypomelas, Bonap. Consp. Av. i. p. 433 (1850).

"*Icterus hypomelas*, Du Bus," Bonap. ut sup.

Icterus dominicensis, et *virescens*, Vig. Zool. Jour. ii. p. 441 (1827).

Psarocolius melanopsis, Wagl. Isis, 1829, p. 759.

De Sagra's Cuba, Ois. pl. 19, bis. (young).

Like the preceding, but with the under tail coverts black (not yellow, as in the two preceding, *P. dominicensis* and *P. portoricensis*), but frequently the shorter under tail coverts are dull gamboge yellow, quite different from the yellow of the tibiae. Yellow space on the rump wide, as in *P. dominicensis*. Bill rather shorter and thicker than in either of the preceding, curved; wing moderate, third quill slightly longest; tail rather long, graduated; legs rather short.

Adult ♂. Shoulders, rump and tibiae yellow, shorter under coverts of the tail dull gamboge yellow, under wing coverts yellow. All other parts of the plumage black. Longer upper coverts of the tail black, all the longer under tail coverts and frequently all the under coverts of the tail black. Bill bluish black, lighter bluish at the base of the under mandible; legs bluish black. Total length about 8 to 8½ inches, wing 3¼ to 3½, tail 3½ to 3¾ inches.

Young. Throat black, body above and below yellowish olive green, shoulders and rump greenish yellow, and in more advanced plumage, tibiae yellow. Under wing coverts yellow, wings and tail brownish green. Adolescent. The black of the adult appearing on the back and breast. In young plumage this bird is *Icterus virescens* and *Psarocolius melanopsis*, as above.

Hab.—Cuba. Spec. in Mus. Acad., Philada., and in Mus. Smiths. Inst., Washington.

This is another of the black species with the rump or lower part of the back yellow, and allied to the two immediately preceding, *P. dominicensis* and *P. portoricensis*. It is not difficult to distinguish from either, by its black under tail coverts. Numerous specimens in the Smiths. Mus. are from the fine collection made in Cuba by Mr. Charles Wright, who most carefully obtained adults and young in all plumages.

14. *PENDULINUS LEUCOPTERYX* (Wagler).

Psarocolius leucopteryx, Wagl. Syst. Av. 16 (1827).

Icterus personatus, Temm. Pl. Coll. ii. liv. 81 (not paged nor dated).

"*Oriolus mexicanus*, Linn." Leach Zool. Misc. i. p. 8.

Oriolus nidipendulus, Gm. Syst. Nat. i. p. 390 (1788)?

Leach Zool. Misc. i. pl. 2. Edwards' Birds, v. pl. 243. Sloan Jam. pl. 258, fig. 3?

Middle and greater coverts of the wing white, forming a large space of that color (white) in the first half of the wing; shoulders yellowish green, uniform with the plumage of the upper parts of the body. Bill thick at base, somewhat curved; wing rather long, third and fourth quills longest; tail moderate or rather short; legs strong. Adult ♂. Entire upper parts of head and body greenish yellow, lighter on the rump, under parts yellow, tinged with green on the breast and sides. Front, lores and throat black (united and forming a mask), wings and tail black. Middle and greater coverts of the wing white, shorter quills widely edged with white. Under wing coverts pale yellow. Bill bluish black, pale blue at base of the under mandible; legs bluish black. Total length 8 to 8½ inches, wing 4¼, tail 3½ inches.

Adult ♀. Like the male, but with the upper parts more strongly tinged with green, and the white of the wing not so large; shoulders and scapulars frequently mixed with black. Young. Like the female, but with the tail olive green; coverts of the wings widely tipped with white, all the quills narrowly edged with grayish white. Adolescent. Middle feathers of the tail black, others green. Shorter quills black, edged with white, others dull brown.

Hab.—Jamaica. Spec. in Mus. Acad., Philada., and Mus. Smiths. Inst., Washington.

This is a common enough, but quite peculiar species, preserving as it does in adult plumage the general colors of the young of several others, and especially of the smaller *P. spurius* of North America. Standing before me in com- 1867.]

pany with the young of *P. dominicensis*, *P. hypomelas* and *P. spurius*, I am almost inclined to regard it as illustrating arrested development.

This bird is exclusively from Jamaica, so far as my information extends, and numerous specimens, now under examination, are in the very fine collection of the birds of that Island, presented to the Smithsonian Institution by William Thomas March, Esq., of Spanishtown, Jamaica. Numerous others in the Smiths. Mus. are in another fine collection from Metcalfe Parish, Jamaica, collected and presented by Professor George N. Allen.

In my opinion this bird is *Oriolus nidiependulus*, Gmelin, as above, founded on descriptions of two supposed species in Sloane's Jamaica, "The Watchy Picket or Spanish Nightingale" and "Another sort of the Watchy Picket." (Nat. Hist. Jamaica, ii. pp. 299, 300).

4. *Icterioides*.

15. *PENDULINUS AURICAPILLUS* (Cassin).

Icterus auricapillus, Cass. Proc. Acad. Philada., 1847, p. 332.

Jour. Acad. Philada. quarto, i. pl. 16, fig. 2.

Back, wings and tail black (no white marks in the wing). Bill moderate or rather short, thick at base, slightly curved; wing rather long, second and third quills longest; tail rather long, graduated; legs moderate. Adult ♂. Back, wings and tail clear lustrous black, without any white spots or marks whatever. Front, lores and throat black, united and forming a wide mask. Head, above, rump and entire under parts golden yellow, paler on the rump. Shoulders yellow, under wing coverts yellow, a few of the longer upper tail coverts black. Bill bluish black, legs dark brown. Total length 7 to 7½ inches, wing 3¼ to 3½, tail 3¼ to 3½ inches. Younger. Entire head and under parts of body dull orange yellow, black feathers appearing on the throat; quills and tail feathers dark brown, rump greenish yellow.

Hab.—Northern South America, New Grenada, Venezuela, Trinidad, Mexico? Spec. in Mus. Acad., Philada., and Mus. Smiths. Inst., Washington.

About the size of *P. chryscephalus* and, like that species, somewhat variable in all its dimensions, a specimen from the Island of Trinidad being the largest and another from Bogota, New Grenada, the smallest. A handsome and easily recognized species, with clear black wings and tail, without a vestige of white markings on either, and differing in that respect from the next succeeding, *P. cucullatus*. Shoulders in the present species, yellow; in *P. cucullatus*, black. Specimens in the Smiths. Mus. are from Bogota and Santa Martha, New Grenada. Two specimens in the Massena collection are labelled as from Mexico, in the handwriting of Mr. Victor Massena. Others in the Acad. Mus. are from Trinidad and Venezuela.

16. *PENDULINUS CUCULLATUS* (Swainson).

Icterus cucullatus, Swains. Philos. Mag., 1827, p. 436.

Cassin, B. of Cal. and Texas, pl. 8.

Middle coverts of the wing white, forming a wide diagonal band across the wing, near the shoulder. Bill rather long, curved, rather slender; wing moderate, third and fourth quills longest; tail rather long, graduated; legs moderate. Adult ♂. Back, wings and tail black, middle coverts of the wing white, shorter quills widely edged with white, primaries narrowly edged with grayish white. Front, lores and throat black, united and forming a wide mask. Head above, rump and entire under parts rich golden or reddish yellow; under wing coverts yellow. Bill bluish black, legs brownish. Total length about 7¼ inches; wing, 3¼; tail, 3¼ to 4 inches. Younger ♂. Black plumage of the back edged with yellowish green, tail narrowly tipped with white, yellow of the head tinged with dull green, and specimens occur in which the entire yellow parts of the plumage are dull greenish yellow, much paler, and of a different shade of yellow from that of the fully-matured bird.

Female. Upper parts dull ashy olive green, tinged with yellow on the head, under parts pale greenish yellow, clearer yellow on the middle of the abdomen and under tail coverts, ashy on the sides, wings ashy brown, coverts tipped with white, tail yellowish green. Total length about 7 inches.

Hab.—Mexico; Texas; Lower California. Spec. in Mus. Acad. Philadelphia, and Mus. Smiths. Inst., Washington.

About the size of the preceding *P. auricapillus*, and generally resembling it, but easily distinguished by its conspicuous white marks on the wings, and the shoulders being black. Numerous specimens in the Smiths. Mus., from Cordova and Mirador, and various localities in the States of Tamaulipas and Coa-

[April,

huila, Mexico, and from Texas. Specimens in the Acad. Mus. are from Mexico, and from Brownsville and "Ringgold Barracks," Texas. Numerous specimens in the Smiths. Mus., also, are from Capt. John Xantus' collection in Lower California, and Colima, Western Mexico.

5. *Pendulinus*.

17. *PENDULINUS SPURIUS* (Linnæus).

Oriolus spurius, Linn. Syst. Nat. i. p. 162 (1766).

Oriolus spurius et varius, Gm. Syst. Nat. i. pp. 389, 390 (1788).

Oriolus castaneus, Lath. Ind. Orn. i. p. 181 (1790).

Yphantis solitaria, Vieill. Nouv. Dict. iii. p. 215 (1816).

Pendulinus nigricollis, Vieill. Nouv. Dict. v. p. 318 (1816).

Oriolus mutatus, Wils. Am. Orn. i. p. 64 (1808).

Wils. Am. Orn. i. pl. 4. Aud. B. of Am., pl. 42, oct, ed. iv. pl. 219.

Catesby Car., pl. 49. Hahn Voeg., pt. v. pl. 5. Buff. Pl. Enl. 607, fig. 1.

Small; bill slightly curved; wing moderate; third quill usually longest; tail rather long, rounded or slightly graduated. Adult male. Head and upper part of back, wings and tail black. All other parts dark chestnut. Greater wing coverts tipped with white, quills edged with grayish white; shoulders chestnut; bill bluish black, lighter at base of under mandible; legs dark brown. Female. Upper parts of head and body uniform olive green, under parts pale greenish yellow, smaller and greater wing coverts tipped with white, quills dark brown edged with grayish white, tail yellowish green. Young male. Like the female, but with the throat black, and (in adolescence) the chestnut of the adult beginning to appear on the breast and sides of the neck. Total length about $6\frac{1}{2}$ to 7 inches; wing $3\frac{1}{4}$, tail 3 inches.

Hab.—Eastern North America; Mexico; Central America; New Grenada. Spec. in Mus. Acad., Philada., and Mus. Smiths., Washington.

An abundant species throughout temperate North America, east of the Rocky Mountains, and extending its winter migration into Mexico and Central America. One specimen in the collection of my friend Mr. Lawrence, of New York, is from Savanilla, New Grenada. Numerous specimens in the Smiths. Mus., from widely distant localities, but showing no specific variation, whether from Nebraska or Guatemala. Numerous specimens also in Mus. Acad., from an equally extensive range of localities.

On this little species the genus *Pendulinus* is founded by Vieillot, but, in my opinion, erroneously, the type or most perfect form being very probably *P. bonand*, or perhaps *P. Wagleri*. The present species is but an humble member of this highly respectable group, and one which shows its characteristics but indifferently—indeed, I am not without a suspicion that it more properly belongs to the group *Hyphantes* as an aberrant form.

18. *PENDULINUS AFFINIS* (Lawrence).

Xanthornus affinis, Lawr. Ann. Lyc., New York, 1851, p. 113.

Like the preceding (*P. spurius*) in form and colors, but smaller, and restricted to Southern North America. Adult male. Chestnut, with the head, back, wings and tail black. Female. Olive green above, pale greenish yellow on the under parts. Total length about $6\frac{1}{4}$ inches; wing 3, tail $2\frac{3}{4}$ inches.

Hab.—Texas; Mexico. Spec. in Mus. Acad., Philada., and Mus. Smiths., Washington.

Appears to be uniformly smaller than *P. spurius*, and not yet found north of Texas. It is, however, only to be distinguished from that species by this character, the shorter wing being the most obvious character in prepared skins. Specimens from Texas and Mexico in Smiths. Mus., and Acad. Mus., and in the collection of Mr. Lawrence, New York. This little bird seems to be the resident species of Texas, and perhaps Mexico; but its near relative, *P. spurius*, is also found in those countries abundantly in the winter, or during the season of migration.

III. Genus *HYPHANTES*, Vieillot.

(Genus *Yphantis*, Vieill. Analyse, p. 33 (1816).)

This is a group of smaller or medium-sized species, characterized by straight, sharp and rather strong bills, well-developed and somewhat pointed wings, 1867.]

and rather short tails. All are of entire symmetry and compactness of structure, and the group represents, in my opinion, the perfection of the family *Icteridae*, and is therefore, I think, to be properly regarded as the typical genus. My business, in the present series of memoirs, is, however, mainly with species, and I have not ventured upon such arrangement.

1. *Hyphantes*.

1. *HYPHANTES BALTIMORE* (Linnæus).

Oriolus Baltimore, Linn. Syst. Nat. i. p. 162 (1766).

Oriolus tricolor, Müll. Syst. Nat. Supp., p. 87 (1776).

Catesby Carolina, i. pl. 48. Buff. Pl. Enl. 506. Vieill. Gal. i. pl. 87. Wils. Am. Orn. i. pl. 1, vi. pl. 53. Aud. B. of Am. pl. 12, oct. ed. iv. pl. 217.

Bill straight, pointed; wing with the first four primaries longest and nearly equal; tail moderate. Adult. Fine reddish orange; head, back, wings and middle tail feathers black. Shoulders orange, greater coverts tipped with white, quills edged with white, tail at base orange, middle feathers black in their terminal two-thirds, others with a medial space black, and largely tipped with orange. Bill bluish, legs bluish brown. Female. Like the male, but with the black parts tinged with brown, and the orange parts paler, and sometimes tinged with green; younger, and frequently mated: the female has the head above and back yellowish or grayish olive, quills brown, tail olive green. Young. Like the young female, but with the quills blacker. Adolescent. Black appearing on the head and throat, tail feathers partly black. Total length $7\frac{1}{4}$ to 8 inches; wing $3\frac{3}{4}$, tail 3 to $3\frac{1}{4}$ inches.

Hab.—Eastern North America; Mexico: Central America. Spec. in Mus. Acad., Philada. and Mus. Smiths., Washington.

Specimens of this well-known species in the Smiths. Mus. are from numerous localities throughout the United States, east of the Rocky Mountains, from Eastern Mexico, Guatemala and Costa Rica; many of them, in collections from Mexico and Central America in very fine adult plumage. One of the most beautiful and familiarly-known birds of the United States. This beautiful little species varies in the shade and *depth* of its orange colors in both males and females. Specimens in the Acad. Mus., from Jalapa, Mexico, are amongst the finest in plumage that I have seen.

2. *HYPHANTES BULLOCKII* (Swainson).

Xanthornus Bullockii, Swains. Philos. Mag., 1827, p. 436.

Psarocolius auricollis, DeWeid, Reise Nord. Am. i. pl. 367 (1839).

Aud. B. of Am. pl. 388, oct. ed. iv. pl. 218.

Size of the preceding, front and wide superciliary stripe orange. Bill straight, pointed, wing rather long, second and third quills longest, tail moderate, rounded. Adult. Stripe through the eye, head above, back and throat, black. Wings brownish black, greater coverts and quills widely edged with white, under wing coverts orange yellow. Front and superciliary stripe, sides of neck and entire under parts of body fine orange yellow, paler on the abdomen. Lower part of back and rump orange yellow, frequently tinged with greenish. Tail, with the middle feathers brownish black in their terminal two-thirds, yellow at base; outer feathers orange yellow, tipped with brownish black. Young. Upper parts yellowish olive green, darker and frequently mottled with brownish black on the back. Total length about 7 to $7\frac{1}{4}$ inches; wing 4, tail $3\frac{1}{4}$ inches.

Hab.—Western North America; Mexico. Spec. in Mus. Acad. Philada., and Mus. Smiths., Washington.

Apparently a frequent species of all the temperate countries of North America on the Pacific Ocean, and inhabiting also a very extensive central region, including the Rocky Mountains. Well represented in the plate of Audubon's folio edition, but indifferently in the octavo. Not intimately resembling any other species.

2. *HYPHANTES ABEILLEI* (Lesson).

Xanthornus Abeillei, Less. Rev. Zool., 1839, p. 101.

Oriolus Costototi, Gm. Syst. Nat. i. p. 385 (1788)?

About the size of the preceding two species, and strictly of the same generic group. Entire upper parts of head and body black. Under parts with the throat and sides black. Narrow line over the eye, sides of the neck and middle of the under parts of the body orange yellow. Wings black, greater coverts white, quills edged with white. Tail with the middle feathers brownish black, other tail feathers yellow, tipped with brownish

[April,

black. Plumage of the rump and upper tail coverts cinerous and greenish yellow at base, and widely tipped with black. Under wing coverts yellow. Bill bluish brown, light blue at base of under mandible, legs bluish brown. Bill straight, pointed, wing rather long, third quill longest, tail moderate, rounded. Total length about $7\frac{1}{2}$ inches; wing 4, tail $3\frac{1}{2}$ inches.

Hab.—Mexico. Spec. in Smiths. Mus., Washington.

Of this curious and little-known bird, I have seen only a single specimen, which was obtained from Messrs. Verreaux, of Paris, and is now in the Smiths. Mus. It is at once recognizable by the sides being black. This bird may be *O. costototi*, Gmelin, as cited above, founded on a description of Hernandez, but not to be so determined satisfactorily.

2. *Melanophantes*.

5. *HYPHANTES XANTHOMUS* (Sclater).

Icterus xanthomus, Sclat. Cat. Am. B. p. 131 (1862).

Bill straight, pointed, thick at base; wing with the second and third quills longest, tail moderate, rounded, legs rather strong. Adult. Shoulders yellow; all other parts of the plumage glossy black. Under wing coverts black, uniform with the other black plumage. Yellow space on the shoulder frequently edged with yellowish white; very pale and nearly pure white in some specimens. Bill black, paler at base of under mandible; legs brownish black. Sexes alike? Total length about $7\frac{1}{2}$ to 8 inches; wing 4 to $4\frac{1}{4}$, tail $3\frac{1}{2}$ inches.

Hab.—Porto Rico; St. Thomas? West Indies. Spec. in Mus. Acad., Philada., and Mus. Smiths., Washington.

This is one of the anomalous forms, not to be arranged without difficulty, and, in structure, a curious species. My present opinion is that it is analogue of *Agelaius* in the genus *Hyphantes*, but am not without a suspicion that it really belongs in the subfamily with *Agelaius* and *Molothrus*. Easily recognized by its short compact structure, straight and almost conic bill, black plumage and yellow shoulders. (The under wing coverts being clear black, not yellow or partly so, as in *Pendulinus cayanaensis* and *P. tibialis*, which this bird resembles in colors only.) Specimens in Acad. Mus., from the Massena collection, without label, numerous specimens in the Smiths. Mus., exclusively from Porto Rico, in the fine collections of Mr. George Latimer.

3. *Aporophantes*.

6. *HYPHANTES PYRRHOPTERUS* (Vieillot).

Agelaius pyrrhopterus, Vieill. Nouv. Dict. xxxiv. p. 543 (1819).

Pendulinus periporphyrus, Bonap. Cons. Av. i. p. 432 (1850).

Bill straight, sharp, rather slender; wing moderate; tail rather long, graduated; feet strong. Adult. Shoulders dark chestnut; all other parts of plumage lustrous black. Bill bluish black, feet brownish black. Total length about 8 inches; wing $3\frac{1}{2}$ to $3\frac{3}{4}$, tail 4 in.

Hab.—Northern South America; Bolivia (Massena Coll.) Spec. in Mus. Acad., Philada.

Another singular and anomalous form in this group, and not to be assigned to any genus without difficulty. The bill is straight, pointed and conic, though rather weak, the wings may almost be said to be rounded, the first quill shorter, the next four nearly equal, and the tail long and partially graduated. At present my impression is that this bird belongs here, though it may be perhaps more properly regarded as *Pendulinus* or possibly *Agelaius*.

The only specimens that I have seen of this curious species are in the Acad. Mus., from the Massena collection, one of which is from D'Orbigny's collection, and is labelled "Chicquitos." Easily distinguished by its chestnut shoulders and black plumage, which combination is peculiar.

IV. Genus *CASSICUS*, Brisson.

Cassicus, used generically, Briss. Orn. ii. p. 98 (1760).

Cassicus, Daud. Traite D'Orn. ii. p. 322 (1800).

Cassicus, Illig. Prod., p. 214 (1811). Cuv. Reg. An. i. p. 394 (1817).

1. *Cassicus*.

1. *CASSICUS HÆMORRHOUS* (Linnæus).

Oriolus hæmorrhous, Linn. Syst. Nat. i. p. 161 (1766).

1867.]

Buff. Pl. Enl., 482. Swains. B. of Braz., pl. 1. Shaw Nat. Misc. x. pl. 365. Prevost Ois. Exot., pl. 71. Dubois Orn. Gal., pl. 43. D'Orb. Cuv. Orn. pl. 37. Briss. Orn. ii. pl. 8.

Bill large, slightly curved, wing long, third quill longest, tail moderate or rather short, feet strong. Adult. Back and rump bright scarlet; all other parts of the plumage lustrous black; bill bluish or greenish yellow; feet brownish black. Sexes alike in colors. Younger. Back and rump yellowish scarlet; other parts of plumage dull brownish black; bill dull greenish yellow, darker at base. Total length, male, about 12 inches; wing $7\frac{1}{2}$ tail 4 to $4\frac{1}{2}$ inches; female smaller.

Hab.—South America; Central and Eastern? Spec. in Mus. Acad., Philada., and Mus. Smiths., Washington.

Apparently one of the most abundant birds of South America. In all collections in this country, usually from Bahia, Rio de Janeiro, St. Katherine, and other points in Eastern Brazil. Perhaps the same also from Guiana and Trinidad. In this species the bill is not so large as in the next succeeding, (*C. affinis*), but in all other characters the two birds are very similar, and probably ought to be regarded as identical.

2. *CASSICUS AFFINIS*, Swainson.

Cassicus affinis, Swains. B. of Braz.

"*Cassicus crassirostris*, Aliq." Bonap. Compt. Rend., 1853, p. 833.

Swains. B. of Braz., pl. 2.

To be distinguished from the preceding by its thicker bill, which is, so far as I can see, the principal character, and but a doubtful species. Not having a sufficient number of specimens which are clearly this bird, to form a satisfactory series or to show gradations, I give it provisionally as distinct, and very nearly as defined by the Prince Bonaparte in Compt. Rend. xxxvii. p. 833.

Like the preceding, and about the same size, but with the bill much larger, especially at base, straighter and wider; wing long; tail rather short. Back and rump bright scarlet; all other parts of the plumage lustrous black; bill bluish yellow; feet brownish black. Total length about $12\frac{1}{2}$ inches; female smaller.

Hab.—Northern South America: "Cayenne." Spec. in Mus. Acad., Philada.

The Prince Bonaparte's diagnosis of this species, as above cited is:—"Grande; d'un noir luisant; la couleur rouge étendue; le bec droit, mais tres-dilaté, énorme à la base." Several specimens in the Massena collection present all these characters, and especially the last, the bill being, indeed, quite entitled to be considered *enormous* at base. The scarlet of the back is of greater extent than in either of the two next succeeding, and perhaps also of the preceding, (*C. hæmorrhous*), as stated by the Prince Bonaparte, as above cited; but I cannot see that this bird is of a more lustrous black than the preceding, as also stated by him in descriptions of the two supposed species—"noir mat" and "noir luisant."

Specimens in the Acad. Mus. from "Cayenne."

3. *CASSICUS UROPYGIALIS*, Lafresnaye.

Cassicus uropygialis, Lafres. Rev. Zool., 1843, p. 290.

Cassicus curvirostris, Lafres. Rev. Zool., 1847, p. 218.

Hahn Voeg., pt. vi. pl. 6?

Like the two preceding, (*C. hæmorrhous* and *C. affinis*), but smaller, and with the bill curved, and the scarlet of the back and rump more restricted. In all specimens now before me, the scarlet on the upper parts is restricted to the rump, and much smaller in extent than in either of the preceding, and frequently assuming a yellowish or copper lustre, (which is the case also in the succeeding species, *C. microrhynchus*). Entire other plumage lustrous black, bill greenish yellow, feet dark brown. Bill thick at base, both mandibles curved, wing long, tail moderate or rather short. Total length about 10 to $10\frac{1}{2}$ inches; wing $6\frac{1}{2}$, tail $5\frac{1}{4}$ to $5\frac{1}{2}$ inches. Female smaller.

Hab.—Northern South America: Bogota; Rio Atrato. Spec. in Mus. Smiths. Inst., Washington, and in Coll. Mr. Lawrence, New York.

Apparently a species of fair respectability. The specimens before me could readily be distinguished from either of the preceding, but perhaps not so easily from the next succeeding, (*C. microrhynchus*), which it more strongly resembles. The more restricted scarlet of the body above is a reliable character, and the bill always presents a degree of curvature not seen in the preceding.

[April,

Very fine adult specimens of this curious species are in an extensive and valuable collection from Bogota, recently presented to the Smithsonian Institution by the Hon. A. A. Burton, late Minister of the United States to New Grenada. It is also in Capt. Michler's collection from the Rio Atrato, and I have seen it in other collections.

4. *CASSICUS MICRORHYNCHUS* (Sclater et Salvin).

Cassiculus microrhynchus, Sclat. et Salv. Proc. Zool. Soc., London, 1864, p. 353.

About the size of *C. uropygialis*, and much resembling it, but with the bill smaller and straighter. Scarlet of the upper parts nearly restricted to the rump, and frequently tinged with yellow, as in that species, but much smaller in extent than in *C. hamorrhous* and *C. affinis*. Plumage lustrous black, (except the rump,) bill greenish yellow, legs brownish black. Bill small; in some specimens nearly straight, but generally slightly curved; (usually not proportionately larger than in the Thrushes, and resembling that of the subgroup *Cassiculus*;) wing long, tail rather short, feet strong. Total length about 9 inches.

Hab.—New Grenada; Panama; Central America? Spec. in Mus. Smiths. Inst., Washington, and in Coll. Mr. G. N. Lawrence, N. Y.

Mainly distinguishable from the preceding, (*C. uropygialis*), by its small bill, generally straighter, but frequently somewhat curved, and, in fact, the approximation to that species is quite general, and yet to be more diligently inquired into. The scarlet of the rump is nearly of the same extent as in that species, and restricted, but in all the specimens under examination the wings seem shorter, and have the third quill longest, and perhaps all the quills narrower than in *C. uropygialis*.

This is the last of the red-backed species. We will now try what can be done with the yellow backs, as follows:—

5. *CASSICUS PERSICUS* (Linnaeus).

Oriolus persicus, Linn. Syst. Nat. i. p. 161 (1766).

Oriolus cacticus, Shaw, Gen. Zool. vii. p. 413 (1809).

Cassicus icteronotus, Vieill. Nouv. Dict. v. p. 315 (1817).

Edwards Birds, pl. 319. Briss. Orn. ii. pl. 9. Buff. Pl. Enl., 184. Swains. B. of Braz., pl. 3. Prevost Ois Exot., pl. 71.

Adult. Lower part of back, and upper and under tail coverts yellow. Tail, with its basal half to two-thirds, yellow. Large spot on the greater wing coverts yellow. All other parts lustrous black; bill yellow, feet dark brown, bill thick, slightly curved, wing long, third and fourth quills usually longest, tail rather short, feet strong. In this species the outer tail feathers are generally yellow in the basal two-thirds of their length, which color becomes shorter in each succeeding feather, and in the middle feathers are seldom more than one-half of their length; (in *C. vitellinus* these proportionate lengths of the yellow color of the tail are reversed). Specimens occur in which the outer tail feathers are yellow in three-fourths of their length. Younger. Yellow of the plumage with a greenish tinge; other parts brownish black, tinged with greenish yellow on the abdomen. Bill brownish or bluish at the base. Total length, ♂, 11 to 11½ inches; wing 6, tail 4 to 4½ inches. ♀. Total length about 8 to 9 inches; wing 5, tail 3½ to 4 inches.

Hab.—Northern South America; Trinidad. Spec. in Mus. Acad., Philada., and Mus. Smiths., Washington.

An abundant and long-known species, to be found in all collections, but not always presenting uniform characters, specimens differing in size and shape of the bill, extent of yellow on the back and tail, and I am not sure that various species might not be made by a sufficiently enterprising and speculative person. The bill in this species seems to be always smaller than in the next succeeding, (*C. vitellinus*), and it is further clearly distinguished from that species by the yellow of the tail, as above described.

Numerous specimens in the Mus. Smiths., from Trinidad, Guiana, "Amazon" and Eastern Peru, ("Head waters of the Huallaga River,") and in the Mus. Acad., from Trinidad, Surinam, "Brazil" and other localities. Specimens from Trinidad seem to be the smallest, and perhaps not quite the same, specifically. Another style in the Mus. Acad., without label, has the bill short, and the yellow of the back extending upwards, and still another, also, without label, has the bill unusually straight and pointed.

6. *CASSICUS VITELLINUS*, Lawrence.

Cassicus vitellinus, Lawr. Proc. Acad. Philada. 1864, p. 107.

Like the preceding (*C. persicus*), but with the bill thicker and more curved, the yellow of the tail much more restricted and reversed, being shortest on the outer feathers. Adult. Entire plumage lustrous black, except the back and upper and under tail coverts and a large space on the greater wing coverts, which are rich yellow, inclining to orange (darker and of a richer shade than in the preceding). Bill yellow, generally tinged with greenish, especially the under mandible; feet dark brown. "Eye opal color, bill greenish yellow, legs black." (Mr. F. Hicks' label, Panama). ♂. Total length 11½ to 12 inches, wing 6½ to 7, tail 4½ to 4¾ inches. ♀. Total length about 9½ inches, wing 4 to 4½, tail 3¾ to 4 inches.

Hab.—Northern South America. New Grenada, abundant at Panama, Turbo, Atrato River, Central America? Spec. in Mus. Smiths., Washington; Mus. Acad., Philada., and coll. Mr. Geo. N. Lawrence, New York.

Clearly a distinct, and in the numerous specimens now under examination, an easily recognized species. It seems to be uniformly rather larger and with the bill thicker than *C. persicus*. The fine rich and deep yellow of the back in the adult of this species, I have never seen in its relative, and is correctly pointed out by Mr. Lawrence as a specific character, as above.

Numerous specimens in the Smiths. Mus., from Panama, and in Col. Michler's collection from the Atrato River. Specimens in the Acad. Mus. labelled doubtfully as from "Mexico."

7. *CASSICUS MELANURUS*, nobis.

Prevost Ois. Exot. pl. 71? Hubner, Samml. Voeg. pl. 99?

In the Massena collection, now a part of the ornithological collection of the Philadelphia Academy, there is a single specimen of a species resembling and allied to *C. persicus*, but with the tail and under tail coverts entirely black. This specimen is labelled as a female and from Guyaquil, in the handwriting of M. Victor Massena, Prince D'Essling, and is the only one that I have ever seen of the species.

Adult ♀. Smaller than either of the preceding, though strictly of the same subgroup, and with the tail entirely black, and the under tail coverts black. A wide transverse band, immediately above the under tail coverts, yellow. Rump and a large spot on the wing, at its insertion with the body, yellow. The longer tail coverts black. All other parts, including the head, neck and back, and entire under parts of the body, wings and tail, black. Bill light colored, feet dark. Bill smaller than in *C. persicus*, pointed; wing moderate or rather long, third quill longest; tail moderate, legs rather short.

Total length 8¾ inches, wing 4¼, tail 3¾ inches. (Female).

Hab.—Guyaquil (Massena Coll.) Spec. in Mus. Acad., Philada.

2. *Cassiculus*.

Genus *Cassiculus*, Swains. Faun. Bor. Am. ii. p. 276 (1831).

8. *CASSICUS MELANICTERUS* (Bonaparte).

Icterus melanicterus, Bonap. Jour. Acad. Philada. iv. p. 389 (1825).

Icterus diadematus, Temm. Pl. Col.

Cassiculus coronatus, Swains. Philos. Mag. 1827, p. 436.

Temm. Pl. Col. 482. Jard. & Selb. Ill. Orn. ii. pl. 45.

Crested, tail entirely yellow, except the two middle feathers and the outer web of the outer feather, which are black. Large, bill straight, tapering, pointed; wing long, third and fourth quills longest; tail rather long; head with a crest of long and slender feathers.

Adult ♂. Back and upper and under tail coverts and tail (except two middle feathers) yellow, middle and greater wing coverts yellow. All other parts of the plumage lustrous black, bill bluish or greenish yellow, legs dark brown. Outer web of outer tail feather usually dark brown, and the yellow feathers of the tail are frequently spotted with brown at their tips. Total length about 12 to 13 inches, wing 6 to 6½, tail 5½ to 6 inches. Female smaller, and with the dark parts of the plumage usually tinged with brown. Total length about 9½ inches. Young. No crest, dark parts of plumage brownish black, yellow parts tinged with green, all the yellow tail feathers edged on both webs with dark brown. An irregular large spot on each side at the base of the upper mandible dull yellow, throat with numerous whitish spots.

Hab.—Mexico. Abundant at Mazatlan, Acapulco. Spec. in Mus. Acad., Philada., and Mus. Smiths., Washington.

The only species of this group having a well defined crest, and easily recog-

[April,

nized. Abundance of specimens in the fine collections of Col. Grayson and Capt. Xantus, from Mazatlan. Specimens in Mus. Acad. labelled Acapulco.

9. *CASSICUS LEUCORAMPHUS* (Bonaparte).

Xanthornus leucoramphus, Bonap. Att. Sc. Ital. 1843, p. 404.

Cassiculus leucoramphus, Bonap. Consp. Av. i. p. 428 (1850).

Cassicus chrysonotus, D'Orb. et Lafres. Mag. Zool. 1838, p. 3?

Bill straight, pointed; tail long; wing long, third and fourth quills longest; legs strong. Adult. Back and spot on the wing coverts bright yellow, all other parts lustrous black. Tail uniform black, upper tail coverts black at their ends, yellow at their bases. Bill bluish at base, with its point or terminal half, ivory white; feet brownish black (no yellow on the abdomen nor under tail coverts, those parts being black, uniform with other parts of the plumage). Younger or female? Entire black parts of plumage tinged with brown, and yellow parts with greenish; bill dark brown at base, dull white at tip.

Total length, male 11 to 12 inches, wing 6, tail $5\frac{1}{2}$ inches. Female? about $9\frac{1}{2}$, wing $3\frac{3}{4}$ to 4, tail $4\frac{1}{2}$ inches.

Hab.—Northern South America, New Grenada, Ecuador. Spec in Mus. Acad., Philada., and Mus. Smiths., Washington.

This is a large species, with a sharp, rather small bill and long tail, easily distinguished from any other bird of this group. It is frequent in collections from Bogota. This species has the tail and entire under parts of the body clear uniform black, without yellow in either. There can be little doubt that *C. chrysonotus*, D'Orb. et Lafres., is the young of this bird, but that the student may judge for himself I give the original description of that supposed species, next succeeding.

Of this fine species numerous specimens are in the Mus. Acad., labelled "Bogota," and in the Mus. Smiths., from Ecuador and New Grenada. If the same as *C. chrysonotus*, which I think quite probable, that name has precedence for the species.

10. *CASSICUS CHRYSNOTUS*, Lafresnaye.

Cassicus chrysonotus, Lafres. Guer. Mag. 1838, p. 3.

D'Orb. Voy. Am. Ois. pl. 52.

"Affinis hæc species *Cassico icteronoto*; sed differt rostro rectiore, cauda longiore et coloribus. Rostrum in exuvia flavo-albidum, in viva basi obscure cæruleo nebulatum, apice depressiusculum; casside frontali angusta tereti quamvis posterius rotundata. Supra et subis totus major dorso postico et uropygio tantum flavo-aurantius, tectricibus caudæ superis ac inferis nigris; alæ his *Cassici icteronoti* longitudine æqualis, sed cauda multo longiore maris nigredine supra nitente, femine obscura; hujus nonnullæ alarum tectrices medise punctis aut striis minimis aurantiis terminatur. An majorum macularum in aliis speciminibus indicium?"

"Longit. maris, 31 cent., femine 27 cent."

"Caudæ maris $14\frac{1}{2}$ cent. *icteronoti* $11\frac{1}{2}$ cent."

"Habit. in Bolivia, Yungas." (Lafresnaye's description as cited above).

The tail, in the figure cited, is represented as plain black. This species I have not seen, at least no specimen to which this description applies, nor like the figure in D'Orb. Voy. above cited. My present impression and suspicion is that it is the young of the immediately preceding species *C. leucoramphus*, and, though figured without the yellow spot on the wing, that character is clearly indicated in the description, as above.

11. *CASSICULUS FLAVICRISUS*, Sclater.

Cassiculus flavicrissus, Sclat. Proc. Zool. Soc. London, 1860, p. 276.

"Nigerrimus: dorso postico, tectricibus alaribus dorso proximis, crisso et rectricibus ad basin flavissimus: rostro plumbeo, apice albicante: pedibus nigris."

"Long. tota maris 10.0, alæ 5.8, caudæ 4.0; femine 8.5, alæ 4.4, caudæ 3.3."

"Hab. in rep. Equator."

"Mus. P. L. 8."

"Four examples. Irides and bill blue: not shy; very noisy, in flocks among large trees in the deep bush; stomach contained seeds and insects." (Dr. Sclater's description, as above cited).

This species is unknown to me and not in any American collection to my knowledge. It is evidently a strongly marked and peculiar species, the base of the tail being yellow, which is its special character in the group *Cassiculus*.

1867.]

(Genus *Archiplanus*, Cabanis).12. *CASSICUS ALBIROSTRIS*, Vieillot.*Cassicus albirostris*, Vieill. Nouv. Dict. v. p. 364. (1816).*Xanthornus chrysopterus*, Vig. Zool. Jour. ii. p. 190 (1825).*Iapus dubius*, Merr. Grub. Ency. xv. p. 277.

Zool. Jour. Supp. pl. 9.

Small, much resembling the preceding (*C. leucoramphus*) and with the same colors, but much smaller. Head with somewhat lengthened and probably erectile feathers; bill thick at base, straight, pointed; wing long, third and fourth quills longest; tail rather long, feet strong. Adult. Rump and large spot on the wing coverts yellow, all other parts deep black, upper tail coverts and tail black. Bill yellowish or ivory white, frequently greenish at base; legs brownish black. Younger. Entire black plumage tinged with brown, and yellow parts with greenish; bill dark brownish, tip paler.

Total length, male, about $8\frac{1}{2}$ inches, wing 4, tail 4 inches. Younger or female, total length about $7\frac{1}{2}$, wing $3\frac{1}{2}$, tail $3\frac{1}{2}$ inches.

Hab.—Brazil, south-eastern South America? Spec. in Mus. Acad., Philada., and Mus. Smiths., Washington.

In colors and general characters this bird much resembles the preceding (*C. leucoramphus*), but is smaller, with the feathers of the head more lengthened and crest-like, and has the yellow of the rump much more restricted. It seems to belong strictly to the same group, and in my opinion is certainly of the group *Cassiculus*. Specimens in the Mus. Smiths. from the Rio Parana, Brazil, and in the Acad. Mus. labelled Brazil.

3. *Ostinops*.(Genus *Ostinops*, Cab. Mus. Hein., i. p. 187 (1851).13. *CASSICUS CITREUS* (Müller).*Oreolus citreus*, Müll. Syst. Nat. Supp., p. 87 (1776).*Oriolus cristatus*, Bodd. Tab. Pl. Enl., p. 20 (1783).*Oriolus cristatus*, Gm. Syst. Nat. i. p. 387 (1788).*Xanthornus decumanus et maximus*, Pall. Spic. Zool., pt. vi. pp. 1, 3 (1769).

Buff. Pl. Enl., 344. Pall. Spic. Zool., pt. vi. pl. 1. Swains. B. of Braz., pl.

32. Dubois Orn. Gal., pl. 34.

Large, with a crest of linear, procumbent feathers; bill large, very thick at base; wing long; fourth quill usually longest; tail long, graduated; legs strong. Adult. Tail feathers yellow, except the two in the middle, which are black; lower part of the back, and upper and under tail coverts, dark chestnut. All other parts of plumage black, generally lustrous, and frequently with a brownish shade; bill yellow; legs brownish black. Younger. Brownish black, with entire upper and under parts of body tinged with dull reddish chestnut; (tail coverts and tail as in adult). Total length, male, about 15 to 18 inches; wing $8\frac{1}{2}$ to 10, tail 8 to 9 inches. Female, 13 to 15, wing $6\frac{1}{2}$ to 7, tail 7 to $7\frac{1}{2}$ inches.

Hab.—South America; Brazil; Ecuador; New Grenada; Trinidad. Spec. in Mus. Acad., Philada., and Mus. Smiths., Washington.

¶ The largest specimens of this abundant species in the series now before me are from Ecuador, and the smallest are from the island of Trinidad; but I fail entirely to detect differences or to discriminate between those from various localities. The female is decidedly the smaller. Numerous specimens in the Mus. Smiths., Washington, and Mus. Acad., Philadelphia.

The finest-plumaged as well as largest specimens that I have seen of this bird are in the very valuable collection made in Ecuador, by the Hon. Charles R. Buckalew, late Minister of the United States to that country, and presented by him to the Smithsonian Institution.

14. *CASSICUS VIRIDIS* (Müller).*Oriolus viridis*, Müll. Syst. Nat. Supp., p. 87 (1776).*Xanthornus virens*, Schreber, Naturforscher, xviii. p. 1 (1782).*Oriolus viridis*, Bodd. Tab. Pl. Enl., pl. 20 (1783).*Cassicus viridis*, Vieill. Nouv. Dict. v. p. 364 (1816).*Oriolus rufirostris*, Shaw, Gen. Zool. Aves, vii. p. 416 (1809).

Buff. Pl. Enl., 328. Naturforsch, xviii. pl. 1.

[April,

Large, bill very thick at base, tapering rather suddenly, elevated in front, straight; wing long, third quill longest; tail rather long; legs and feet very strong. Head with a crest of very slender, recumbent feathers. Adult male. Tail yellow, except the two middle feathers, which are dark-greenish brown; back and upper tail coverts, lower part of abdomen, tibiae and under tail coverts dark chestnut. Quills black. All other parts of plumage dark yellowish green, lighter on the under parts. Bill greenish yellow, legs black. Female. Smaller than the male, but similar in colors. Young. Tibiae green. Total length, male, about 18 inches; wing about 10, tail 7 to $7\frac{1}{2}$ inches. Female. Total length about 14; wing $7\frac{1}{2}$ to 8, tail $5\frac{1}{2}$ inches.

Hab.—Northern and Eastern South America. Spec. in Mus. Acad., Philada.

This large species is to be found in all collections, and has long been known to naturalists, but, like rather numerous common species, must be studied carefully in connection with its later-discovered allies. Specimens in the Mus. Acad. have no labels stating locality, but this bird comes abundantly in collections from Brazil, and I have seen it from more northern countries of South America.

15. *CASSICUS YURACARIUM*, D'Orbigny et Lafresnaye.

Cassicus yuracarus, D'Orb. et Lafres. Mag. Zool., 1838, p. 2.

Cassicus Devillii, Bonap. Consp. Av. i. p. 427 (1850).

D'Orb. Voy. Ois., pl. 51, fig. 1. Castelnau Voy. Ois., pl. 19, fig. 1.

Large, resembling the preceding, and about the same size, but with a large naked space at the base of the lower mandible, and the bill black, tipped with yellow. Back, wings and abdomen dark chestnut, tail yellow, except two middle feathers, which are reddish brown. Head, neck and breast and upper part of back yellowish green; quills brownish black, edged externally with dark chestnut; legs black. Female like the male, but smaller. Younger like the adult, but with the chestnut on the under parts more restricted, and on the back mixed with green. Head (in adult) with a crest of slender recumbent feathers, wing long, third quill longest, tail moderate or rather long, legs very strong. Total length, male, about 18 inches; wing $9\frac{1}{2}$, tail $7\frac{1}{2}$ inches. Female. Total length about 15; wing $7\frac{1}{2}$, tail $6\frac{1}{2}$ to 7 inches.

Hab.—Northern South America; New Grenada; Bolivia; Peru. Spec. in Mus. Acad., Philada., and Mus. Smiths., Washington.

About the size of the common *C. viridis*, but easily distinguished by its chestnut-colored back and abdomen, and the large naked space at the base of the lower mandible. Numerous specimens in the Mus. Smiths., from various localities in New Grenada, and in Mr. Lawrence's collection from the "Rio Napo." Specimens in the Acad. Mus., from the fine collection made by the Hon. John Randolph Clay, while Minister of the United States to Peru. Very handsomely figured by D'Orbigny, as above.

16. *CASSICUS ATRO-VIRENS*, D'Orbigny et Lafresnaye.

Cassicus atro-virens, D'Orb. et Lafres. Mag. Zool., 1838, p. 1.

D'Orb. Voy. Am. Ois., pl. 51, fig. 2.

Like the preceding, but smaller and of a darker green color. Bill very thick at base, tapering abruptly; wing long, second, third and fourth quills longest and nearly equal; tail rather long, legs strong. Adult? Back and upper and under tail coverts dark chestnut, a large frontal space pale yellow; all other parts of the body, above and below and wings, dark olive green, darker on the head, paler on the throat and neck. Tail with the middle and outer feathers dark olive, nearly uniform with the body; intermediate feathers (of the tail) yellow. Bill greenish yellow, legs black. Tibiae green. Quills brownish black. Total length about 15 inches; wing $8\frac{1}{2}$ to 9, tail 7 inches.

Hab.—Bolivia. Spec. in Mus. Acad., Philada.

The only specimen of this species is D'Orbigny's type in the Massena collection, (Mus. Acad.) It is singularly like all the preceding, but of a darker green color, nearly uniform on all parts, but rather darker on the head above, and back. This darker color is the principal character on which rests the species, so far as I can discover. In this specimen there is no crest, but the feathers of the head are somewhat lengthened only. I regard it as possible that this species and the next may be identical, but such is not my opinion at present. Fairly represented in D'Orbigny's plate.

17. *CASSICUS ALFREDI*, Des Murs.

Cassicus Alfredi, Des Murs, Castelnau's Voy. Am. Ois., p. 67 (1855).

"*Ostinops angustifrons*." Jules Verreaux' label in Mus. Smiths.,

Casteln. Voy. Am. Ois., pl. 19, fig. 2.

1867.]

Several specimens in the Acad. Mus. and Smiths. Mus. seem to be this species. All are labelled "Bogota," and four specimens in the Smiths. Mus. are certainly correct, and so are other specimens in Mr. Lawrence's collection. This bird differs from *C. viridis* and *C. atrovirens*, in having the head, in front, yellow, and this yellow color strongly tinged the neck and the throat; and, in nearly all specimens, the body, above and below, is more or less tinged with reddish brown, sometimes strong, but frequently faint. Nearly all the feathers of the crown are lengthened and crest-like in a greater degree than in *C. atrovirens*. At present my impression is that this is a distinct species, though no specimen that I have seen seems to be entirely adult.

About the size of *C. viridis*, and of the same general form and color, but with the wings and tail longer, and with a large space in front, and frequently extending over the top of the head, yellow. Back and rump reddish brown; the latter (rump) usually with a yellowish tinge; sides of abdomen and under tail coverts reddish or yellowish brown. Entire other plumage olive green; head, in front, yellow, throat and neck strongly tinged with yellow. Wings brownish black, middle and outer feathers of tail greenish brown, other tail feathers yellow. Bill pale yellow, legs dark brown. Total length, male, about 17 inches; wing $9\frac{1}{2}$, tail $7\frac{1}{4}$ inches. Female? Total length about 13; wing $7\frac{1}{2}$, tail $6\frac{1}{2}$ in.

Hab.—Northern South America; New Grenada. Spec. in Mus. Acad. Philada., and Mus. Smiths., Washington.

This bird comes occasionally in Bogota collections, though not commonly. It seems to have the wings rather longer, and perhaps the tail also longer, than in either *C. viridis* or *C. atrovirens*, and my opinion is that it is distinct from either. It differs from *C. angustifrons* in having the bill always yellow, (not black at all ages, as in *C. angustifrons*).

In the splendid collection of Bogota birds, recently presented to the Smithsonian Institution by the Hon. A. A. Burton, late Minister of the United States to New Grenada, there are four specimens of this species, and others also, from Bogota, are in the Acad. Mus., Philadelphia, and in the collection of my friend Mr. Lawrence, of New York. This seems to be clearly the bird described and figured by Des Murs, as above, the lengthened feathers of the head being quite peculiar and characteristic, and partially shown in Castelnau's plate, as above.

18. CASSICUS ANGUSTIFRONS, Spix.

Cassicus angustifrons, Spix Av. Bras. i. p. 66 (1824).

Spix Av. Bras. i. pl. 62.

Differs from all the preceding species in having the bill black at all ages. Large; a few feathers of the crown lengthened and crest-like; bill straight, thick at base, flattened laterally, not so large as in the preceding species. Wing long, fourth quill longest; tail long, rounded, feet strong. Adult. Entire plumage greenish brown or dark chocolate color, lighter and tinged with yellowish green on the head and throat, and, in some specimens, on the under parts of the body. Back and upper and under tail coverts dark reddish chestnut. Wings brownish black, middle feathers of the tail brownish black, others yellow, bill and feet brownish or bluish black, lighter and sometimes nearly white at the tip. Younger. Head and neck strongly tinged with dull yellow, and tail tinged with green. Sexes alike and distinguished mainly by size? Total length, male, about 18 inches; wing $10\frac{1}{2}$, tail 9 inches. Female. Total length about $15\frac{1}{2}$; wing 8, tail $7\frac{1}{4}$ inches.

Hab.—Northern South America; Upper Amazon; Rio Napo. Spec. in Mus. Acad., Philada., and Mus. Smiths., Washington.

This large species is always distinguishable by its black bill, and is darker and differently colored in plumage than either of the preceding. Specimens in the Smiths. Mus. are from Lieut. Herndon's collection on the Amazon River, and in Mr. Lawrence's collection from the Rio Napo. In the Acad. Mus. fine specimens are labelled "Pebas, Haut-Amazon." Very indifferently figured by Spix, as above, but recognizable by its black bill, and altogether a peculiar and entirely respectable species, not troubled with near relations.

19. CASSICUS BIFASCIATUS, Spix.

Cassicus bifasciatus, Spix Av. Bras. i. p. 65 (1824).

Spix Av. Bras. i. pl. 61.

Bill flattened laterally or compressed, a large naked space at the base of the under mandible, which space is integral, (not divided into two spaces, as in the two next succeeding

[April,

species). Head with a few long crest-like feathers, not so long nor so narrow as in *C. guatimozinus*, but longer than in *C. Montezumæ*. Wing moderate or rather long, third quill longest, tail rather long, rounded.

Adult. Head and breast brownish black, entire upper parts of body, abdomen, under tail coverts and *tibiæ* light chestnut. Tail yellow, the two middle feathers dark brown. Bill with its basal two-thirds black, tip yellowish white. Legs brownish black. Sexes alike. Total length, male, 18 to 20 inches; wing $9\frac{1}{2}$ to 10, tail 8 inches. Female. Total length about 14 to 15 inches; wing 8, tail 6 to $6\frac{1}{4}$ inches.

Hab.—Northern South America; Para. Spec. in Mus. Acad., Philada.

This species and the two next succeeding are much alike in colors and general form. In this species the naked space is always integral, as above described, and the *tibiæ* light chestnut, uniform with the abdomen and upper parts of the body.

Specimens in the Acad. Mus. certainly from Para, Northern Brazil. Spix's figure, above cited, is near enough for practical purposes, as the Professor of mathematics says.

20. CASSICUS MONTEZUMÆ (Lesson).

Cassicus Montezuma, Less. Cent. Zool., p. 33 (1830).

Less. Cent. Zool., pl. 7. Gervais Atl. Zool., pl. 33.

Like the preceding, but with the naked space on the cheek partially divided by a line of short, imbricated feathers above the lower edge of the lower mandible, and the *tibiæ* black. Head with a few linear, crest-like feathers, (short and inconspicuous, not so long as in either *C. bifasciatus* or *C. guatimozinus*). Colors much as in the preceding; head, breast and *tibiæ* brownish black, body above and below dark chestnut, tail yellow, except the two middle feathers, which are brownish black. Basal half to two-thirds of bill black, tip yellowish or reddish white, feet brownish black. Sexes alike. Total length, male, 18 to 20 inches; wing 10, tail 8 inches. Female smaller.

Hab.—Mexico; Central America. Spec. in Mus. Acad. Philada., and Mus. Smiths., Washington.

Always has the naked space at the base of the under mandible divided by an imperfect line of short feathers, as represented in Lesson's plate, cited above, and the *tibiæ* black, (not light chestnut as in the preceding). This seems to be an abundant species of Mexico and Central America. Lesson's type in Acad. Mus. is labelled "Mexique," others are from San Juan de Nicaragua. Numerous specimens in Smiths. Mus. are from the very fine collections made by Dr. C. Sartorius near Vera Cruz, Mexico, by Mr. O. Salvin in Guatemala, and Mr. J. Carmiol at Angostura and San Carlos, Costa Rica.

21. CASSICUS GUATIMOZINUS (Bonaparte).

Ostinops guatimozinus, Bonap. Compt. Rend., 1853, p. 833.

Larger than either *C. bifasciatus* or *C. Montezumæ*, darker-colored, and the crest feathers longer and more slender; bill thicker at base, and naked space at base of lower mandible completely divided by a line of short feathers. Bill very thick and wide laterally at base, straight, pointed, wing moderate or rather long, tail rather long, legs strong. Adult. Head and entire under parts black, upper parts of body and under tail coverts dark-purplish chestnut, tail yellow, except the two middle feathers, which are brownish black. Bill with the basal two-thirds black, tip yellowish white, legs brownish black. Younger? Sides purplish brown, otherwise as in adult. Total length, male, about $21\frac{1}{2}$ inches; wing $10\frac{1}{2}$, tail $8\frac{1}{2}$ inches. Female smaller. Total length about $15\frac{1}{2}$ inches.

Hab.—New Grenada; "Rio Truando;" "Turbo;" Spec. in Mus. Smiths., Washington.

This species is of the same general form as the two immediately preceding, but is much darker in colors, and not difficult to distinguish. The only specimens that I have seen are two in Capt. Michler's collection, made during a survey of the Rio Atrato, New Grenada, now in the Smiths. Mus. The crest in this species is in front, directly at the base of the upper mandible, and is composed of very narrow, almost thread-like feathers, probably erectile.

4. *Ocyalus*.

(Subgenus *Ocyalus*, Waterhouse, Proc. Zool. Soc., London, 1840, p. 183.)

22. CASSICUS LATIROSTRIS, Swainson.

Cassicus latirostris, Swains. Cat. Cy., p. 358 (1838).

Cassicus (*Ocyalus*) popayanus, Waterh. Proc. Zool. Soc. London, 1840, p. 183.

1867.]

Bill thick at base, very wide and convex in front, wing long, primaries attenuated at their ends, tail rather short, legs moderate or rather weak. Adult. Head above dark chestnut, body above and below rich purplish black, wing lustrous greenish black, four middle feathers of the tail lustrous black, others yellow, widely tipped with black, and outer feathers edged with black on their outer webs. Bill pale bluish yellow, legs brownish black. Sexes alike? Younger. Back tinged with the same chestnut as the head, and wings nearly plain black, the green lustre being scarcely apparent. Total length about 11 inches; wing 8 to 8½, tail 4 to 4½. Female slightly smaller.

Hab.—Northern South America; New Grenada; ("Popayan," Mr. Waterhouse;) Peru, (Mr. Swainson). Spec. in Mus. Acad., Philada.

This is a richly-colored bird in adult plumage, and represents a strongly-marked subgeneric group in the genus *Cassicus*, if not entitled to generic distinction with the next species. The general form is short and compact, with the tail also short, or rather so, and the wings long, with the primaries attenuated at their points, feet rather slender. As Mr. Swainson says truly, a strong "fissirostral type." The only specimens that I have seen are male and female in Mus. Acad., Philadelphia, which were obtained from Messrs. Verreaux, Paris, labelled as from New Grenada.

23. *CASSICUS WAGLERI*, G. R. Gray.

Cassicus Wagleri, G. R. Gray, Gen. Birds, ii. p. 342 (1847).

Gray's Gen. ii. pl. 85.

Larger than the preceding, but strictly of the same subgroup. Bill very large and convex in front, wing long, primaries strongly attenuated at their ends, tail rather short, graduated, feet moderate. Adult. Entire head, lower part of back, sides of abdomen and under tail coverts dark chestnut; wings back and body below lustrous greenish black; tibia brownish black. Two middle feathers of the tail and outer webs of two external feathers clear black, other tail feathers yellow. Bill yellowish green, legs brownish black. Head with a few filiform crest-like feathers. Sexes alike. Younger. Entire body above and below tinged with dull chestnut, nearly uniform in shade with the head, (black of the back and body beneath, in the adult, scarcely distinguishable in the young), wings dull black with little greenish lustre. Bill brownish, yellow at point; "bill in living bird yellowish white" (Prof. F. Sumichrast). "Iris light blue," (Mr. J. Carmiol). Total length, male, about 14 inches; wing 8½ to 9, tail 5½ inches. Female. Total length about 12 inches; wing 7½, tail 4½ to 5 inches.

Hab.—Mexico; Central America; New Grenada. Spec. in Mus. Acad. Philada., and Mus. Smiths., Washington.

Abundance of specimens in the Smiths. Mus. from the magnificent collections of Prof. F. Sumichrast in Mexico, and Dr. A. Von Frantzius and Mr. Julian Carmiol in Costa Rica. The latter labelled "San Jose," "Angostura," "Turrialba" and "San Carlos." Also from Guatemala, and Panama and the Rio Truando, New Grenada. In the younger bird, the attenuation at the ends of the primary quills is not so strongly marked as in the adult. This interesting species is accurately and handsomely figured by Mr. G. R. Gray in his great work, "The Genera of Birds," cited above.

5. *Clypicterus*.

(Genus *Clypicterus*, Bonap. Cons. Av. i. p. 426.)

24. *CASSICUS OSERYI*, Deville.

Cassicus Oseryi, Dev. Rev. Zool., 1849, p. 57.

Castelnau, Voy. Am. Ois., pl. 18, fig. 3.

"Bec fortement renflé à sa base formant un bourrelet arrondi sur la partie frontale, s'étendant jusqu'à la naissance de l'œil; lorum noirs, bord des paupières garni de petites plumes noirs; en dessus d'un brun roux chatain, plus foncé dur le derrière de la tête, plus clair et passant au vert olive sur la partie frontale; gorge et poitrine d'un jaune plus ou moins olivacé, changeant un peu au gris sous la gorge; ventre mêlé de chatain et de jaune olivâtre. Aile à première remige noir; les deuxième, troisième, quatrième, cinquième et sixième ayant à leurs bords externes, et au tiers de leur longueur à peu près, une bande jaune allant en s'éclaircissant, et s'élargissant de la deuxième à la sixième; les grandes couvertures des ailes ayant du côté du bord interne une bande rousse chatain, puis une autre d'un jaune olivâtre faiblement colore jusqu'à la bannette du milieu, laquelle est noire, ainsi que tout le bord interne. Pied robustes; le ponce et son ongle très-forts. Queue jaune, à l'exception des quatre pennes médianes, et le bord externe de la première penne laterale, qui sont d'un brun verdâtre foncé. Long. tot 29 cent. 3 mill. Long. de l'aile 19 c. 5 m. Long. du bec 5 c. 2 m. Larg. du renflement du bec 2 c. 3 m. Long. de la queue 12 c. 5 m."

[April,

"Hab.—Pébas, sur le Haut-Amazone." (Deville, as above.) "Rubro-castaneus; pectore fronteque flavo-olivaceus; remigibus fuscis: cauda flavissima, rectricibus mediis marginemque externarum olivaceis." (Bonap. Consp. Av. i. p. 426.)

These are the original descriptions of a species of which the Prince Bonaparte makes a genus, as above, but which I have not seen. The figure in Castelnau's Voy., above cited, looks much like a young bird, but is different from any species known to me. This bird is given in the catalogue of the Baron Lafresnaye's collection, now in the museum of the Boston Natural History Society.

(The following may be an additional species of this genus.)

25. *CASSICUS LEUCURUS*, De Wied.

? *Cassicus leucurus*, De Wied, Beitr. Naturg. Bras. iii. p. 1245 (1831).

"Der weisschwänzige Cassicke. Wird *Jomongo* genannt."

"Er lebt nach Aussage der *Gimacan*-Indianer, häufig an den Ufern des Rio Pardo im Sertong. Der Vogel ist schwarz, mit weissem Schwanz. Sein Nest hängt er gesellschaftlich, wie der *Japu*, *Guach* und *Japui*, an den Bäumen über dem Wasser auf. Es hat die Gestalt wie bei obigen Arten. Ich habe diesen Vogel durch Zufall nicht zu sehen bekommen."

Not subsequently determined, and, of course, may have been erroneously reported to the Prince Maximilian.

V.—Genus *AMBYLCERCUS*.

(Genus *Amblycercus*, Cabanis Mus. Hein. i. p. 190.)

1. *AMBYLCERCUS SOLITARIUS* (Vieillot).

Cassicus solitarius, Vieill. Nouv. Dict. v. p. 364 (1816).

Cassicus nigerrimus, Spix, Av. Bras. i. p. 66 (1824).

Spix, Av. Bras. i. pl. 63.

Entirely black, except the bill, which is yellowish white. Head with the feathers of the crown somewhat lengthened, and probably partially erectile; plumage of the back long, ample; wing rather short; fourth quill longest; tail long, rounded; legs strong. Bill straight, flattened laterally or compressed. Black plumage with slight greenish lustre in adult. Sexes alike. Total length about 10½ inches; wing 5, tail 5¼ inches.

Hab.—Northern and Central South America; Brazil; Ecuador; Bolivia; (Dr. Sclater). Spec. in Mus. Acad., Philada.

A clear black species, frequent in collections from Brazil. The feathers of the head are lengthened in this bird, and the plumage of the back, though ample, is not so much so as in the next succeeding, which is also a plain black species. Specimens in the Acad. Mus. from Brazil, and in Mus. Smiths. from the collections of the Hon. Charles R. Buckalew in Ecuador, and of Com. T. J. Page in Paraguay. Spix's attempt to represent this respectable species, as above, miscarried palpably.

2. *AMBYLCERCUS PREVOSTII* (Lesson).

Amblyramphus Prevostii, Less. Cent. Zool., p. 159 (1830).

Less. Cent. Zool., pl. 54. Gervais, Atl. Zool., p. 34.

Much resembling the preceding, but smaller, and with the feathers of the crown short, (not lengthened, as in the preceding). Bill thick at base, flattened laterally, and not so much convex above as in the preceding. Wing rather short, rounded; fourth and fifth quills longest; tail rather short; legs moderate; plumage of the back very profuse, lengthened. Adult. Entirely black, with little or no lustre; bill yellowish white; legs dark brown. Sexes alike. "Eye yellowish white, legs light-lead color, bill greenish yellow." (Mr. Frederick Hicks, Panama.) Total length, male, about 9¼ inches; wing 4¼, tail 4½ inches. Female. Total length about 8½ inches; wing 3¾, tail 3¾ inches.

Hab.—Mexico; Central America; New Grenada. Spec. in Mus. Acad. Philadelphia, and Mus. Smiths., Washington.

This smaller species much resembles the preceding in form and color, but is quite distinct. The most immediately available characters are the smaller size and lengthened feathers of the back in the present bird, and the bill is more flattened on the culmen. In a large number of specimens no one has the feathers of the crown lengthened, as in the preceding. Numerous specimens in the Smiths. Mus. are from the fine collections of Dr. C. Sartorius at Mirador, near Vera Cruz, Mexico, of Prof. F. Sumichrast and Mr. J. Carmiol in Costa 1867.]

Rica, and also from Guatemala and Panama, New Grenada. Specimens in Acad. Mus. from Mexico and New Grenada, and in all other collections from everywhere else in Mexico and Central America.

Here endeth the *Icteride*, so far as the knowledge of the present writer doth warrant him in attempting to compass.

May 7th.

MR. VAUX, Vice-President, in the Chair.

Twenty-four members present.

The following was presented for publication :

"Notes on *Micropus leucopterus*." By Henry Shimer, M. D.

A letter was read from George W. Tryon, Jr., proposing to deposit his Conchological Library with the Academy on certain conditions, which, on resolution, was accepted. The conchological works consist of about 100 bound volumes, and 60 unbound volumes and pamphlets. With this addition to the Library of the Academy, it will contain nearly every known work published on conchology.

Prof. Leeds made some remarks on the inspiration of oxygen as a remedial agent. He stated that he had inhaled ten gallons, and a friend twelve gallons, without any apparent bad effect.

May 14th.

The President, DR. HAYS, in the Chair.

Forty members present.

The following was presented for publication :

"Contributions to the History of the Vertebrates of Mesozoic Periods in New Jersey and Pennsylvania." By E. D. Cope, A. M.

The death was announced of Dr. C. M. Diesing, of Vienna, Correspondent.

May 21st.

The President, DR. HAYS, in the Chair.

Twenty-seven members present.

The following were presented for publication :

"Descriptions of five new Unionidæ, &c." By Isaac Lea, LL. D.

"Description of a new genus of Plants." By Alphonso Wood.

May 28th.

The President, DR. HAYS, in the Chair.

Thirty-seven members present.

The following were elected correspondents :

E. E. Adams, D. D. ; Alexander Winchell, Ann Arbor, Mich. ; Henry Pleasants, Pottsville, Pa, and D. Antonio Raimondi, M. D., Lima, Peru.

[May,

The following were elected members :

Asa Whitney, George Whitney, John R. Whitney, Edward Clarke, Clarence H. Clark, Frank H. Clark, Theodore H. Morris, O. Nichols Beach, James N. Whelen, Wm. A. Whelen, Alexander Whilldin, Orlando Crease, Andrew I. Sloan, D. Murray Cheston, M. D., Edw. C. Knight, Frank Hazeltine, Wm. R. White, Jr., Daniel H. Rockhill, Franklin S. Wilson, Rev. J. G. Ralston, and Clarence S. Bement.

On favorable report of the Committee, the paper of Prof. Cope, read May 14th, was ordered to be published in the Journal.

On favorable report of the Committees, the following were ordered to be published :

Notes on MICROPUS (LYGARUS) LEUCOPTERUS, Say, ("The Chinch Bug.")
With an account of the great Epidemic Disease of 1865 among Insects.

BY HENRY SHIMER, A. M. M. D.,

Mount Carroll, Illinois.

During the few years preceding the summer of 1865, I was very favorably located for observing the great grain enemy of the West—"The Chinch Bug"—in the midst of one of the most important agricultural regions in the valley of the Mississippi, and with some personal interest in that direction. I gave the subject the most thorough investigation in all its bearings, during a period of several years, and therefore believe that I observed some facts worth recording, although it is an old subject—one upon which much has been written—much, however, upon mere conjecture or ephemeral observation, without sufficiently thorough investigation; hence, often widely departing from the truth. (See the various printed reports.)

With the wide-spread destruction that followed the rise and progress of the "Chinch Bug," most western men are quite well acquainted, and many in pocket sadly familiar. Under the genial influence of a favorable clime, the "chinch bug" attained the maximum of its development in the summer of 1864, in the extensive wheat and corn fields of the valley of the Mississippi; and in that single year, three-fourths of the wheat and one-half of the corn crop were destroyed throughout many extensive districts, comprising almost the entire North-west, with an estimated loss of more than one hundred millions of dollars in the currency that then prevailed; which, if thus continued for one hundred years, and estimating the value of money at the legal rates of our State, annually, would amount to the enormous sum of one hundred and thirty-seven thousand seven hundred and ninety-six millions of dollars lost to the farming community alone. By estimating the effect of this loss upon the various associated interests of the nation, and by observing the tendency of this insect, unchecked, to spread everywhere in this our rapidly developing country, we can easily see that it would fall short of the true estimate to place the entire loss to this continent, if uninterruptedly continued for one hundred years, equal to a sum sufficiently vast to engulf the present wealth of the world, and all from an apparently "insignificant insect"—a "bug," popularly unworthy of notice, as a single specimen.

In view of these great facts, I gave the subject my most untiring attention; the insect enemies of the chinch bug were carefully watched, everything bearing upon it was noted, hoping that some practical method might be developed, or some enemy discovered, that would lead us to hope for its ultimate control, if not destruction.

The ravages of the "chinch bug" have been marked with varying paroxysms, from year to year, for a long time, among the records of which it will be seen that Mr. Walsh (Transactions Ill. Agricultural Society,) estimates the loss in 1867.]

Illinois alone, in the year 1850, to have been four millions of dollars. What fatality produced the subsequent paroxysms in its development, and so greatly diminished its destructiveness for several years, so that it scarcely excited much attention, it was not my province to behold; and I believe no record has been made.

The pleasant dry summers, and the snowy protection of the accompanying winters for several successive years, so fostered these insects that the harvestmen found them in every field in unnumbered millions in 1864, blasting the fairest prospects of the bone and sinew of the land. It was my privilege, in the spring of 1864, to observe the parent insects fulfil the principal office of nature by propagating their species, and quietly die from natural laws after the great object of their being was accomplished. Day after day, it was the greatest pleasure of all my numerous entomological observations, in a scientific point of view, while I deplored their devastations, to mark the progress of the vast hosts of their offspring towards the imago state everywhere around me. From the platforms of the grain reapers in the prairie harvest fields, it would have been no difficult task to gather these little insects by bushels; and when the dry straw of the wheat fields no longer afforded them nourishment, they took up their line of march for the corn-fields, according to their usual well-known custom, on this occasion almost literally covering the ground in many places; sometimes gathering together into piles, and here casting their skins. This, being observed carelessly by farmers and others, leads them to declare that "the 'chinch bugs' were destroying each other," "that they were dying," &c.; the dry shells remaining behind being mistaken for the insect itself.

I have seen the columns of these insects a full week on the march across meadows and pasture fields from the wheat to the corn field; and have even seen them swim a small stream of water that crossed their line of march. In former years the few border rows of corn, together with the "fox-tail grass," (*Setaria*), carelessly left among the corn in cultivating, usually satisfied them. This latter grass is usually attacked in preference to the corn.

In 1864 whole corn fields were overrun by them; the stalks, especially below the ears, blackly covered through the day, were bleeding and literally raw from their numerous punctures. At length, when they had attained the perfect state during the warm part of bright sunny days, they took to their wings, and literally filled the atmosphere, not much unlike an April snow storm. This interesting phenomenon induced many to believe that they were leaving the country; but it was for an entirely different purpose—that of choosing their mates—for they never fly except in the love season. After a few days they might be found paired in corn fields, and other proper breeding grounds producing a new generation. At this time, in the month of August, 1864, my attention was very favorably directed to a small field of tender, thickly-sown corn for fodder, where they congregated in immense numbers, and continued until the frosts of autumn had killed the corn that they did not consume, and developed their progeny in unnumbered millions. During the day they resorted to the stalks of corn to feed upon the juice, but they passed the night usually upon the ground.

The two principal insect enemies that I observed among this autumn brood were a very common species of "lady bird," (*Hippodamia maculata*), and a species of the "golden-eyed fly," (*Chrysopa Illinoisensis*, Shimer, Proceedings Entomological Society, vol. iv., p. 208). Both these enemies were very numerous—especially the former, which could be counted by hundreds on every square yard of ground after shaking the corn; but the chinch bugs were so numerous that these hosts of enemies made very little perceptible impression among them. After the early autumn frosts, they left their feeding grounds, on foot, in search of winter quarters; none could be seen on the wing, as at harvest time, above alluded to. For a winter retreat, they resorted to any convenient shelter they might chance to find, as long grass, weeds, boards, pieces of wood rails, fallen tree leaves, &c., &c.

[May,

In January, 1865, I next examined their condition; those that I found in the sheathes of the corn leaves above the snow, and had been thus exposed during the previous severe weather—when, for several successive days, the thermometer was 15° — 20° below zero—were invariably found dead, without exception, and those beneath the snow were alive. This observation was made in the common farm cornfields, as they might be found anywhere all over the wide country; for in autumn the chinch bugs remained in great numbers in the corn husks, and under the sheathes of the blades, as well as in other winter retreats. Upon various occasions, as the winter advanced, I brought in corn husks, filled with ice, enclosing the chinch bugs in the crystallized element; when the ice was thawed, they were able to run, apparently unaffected by that degree of cold. It is therefore proved that these insects possess vitality sufficient to withstand the effect of a temperature below the freezing point, and perhaps below zero, as must have been their condition in these ice-bound husks; but when in the open air, exposed to the sweeping prairie winds, 15 or 20 degrees below zero, for a long time, they succumb to the cold.

March 7, 1865. The snow having cleared off from the ground, I examined the condition of a host of these chinch bugs that had chosen for their winter covering cord-wood sticks, lying on the ground, entirely surrounded by frost and ice; of these, 20 per cent. were living; those that were more fortunate in their selection of winter quarters fared much better. From a single handful of leaves, picked up at one grasp from beneath an apple tree, I obtained 355 living and 312 dead chinch bugs; and of their lady-bird enemies that had entered the same winter quarters with them, 50 were living and 10 dead. Of these chinch bugs, I placed a number in comfortable quarters in the house, in a small paste-board box—not in a stove room—together with some coleopterous insects, casually gathered among the chinch bugs; after one month, I found the latter all dead and the former living.

The entire month of March was rain, snow, thawing, freezing, alternately, seeming to be very uncomfortable for any living creature to remain out of doors with so poor a shelter, and on top of the ground.

April 1—6. I again made repeated examinations of these chinch bugs in their winter quarters, and found about the same proportion of them living as noted on the 7th of March. At this time they wandered away, on foot, from their winter quarters, in quest of food.

May 16, 1865, was a delightful, mild, bright, sunny, summer-like day; and I again, for the last time, observed the same highly-interesting phenomena, which I have noticed above as occurring after the harvest of 1864—the atmosphere swarming with chinch bugs on the wing. This is their spring; that was their autumnal nuptial season—their season of love. These remarkable little creatures prefer to conduct their courtships under the searching gaze of the noon-day sun, instead of at the midnight hour. They were so numerous, alighting on the pavements in the village, that scarcely a step could be taken without crushing many of them under foot. In a few days, they had all disappeared; their breeding grounds were chosen, where they could be found in great numbers, often in pairs. I first noticed this disposition of the chinch bug to take wing under the promptings of the love passion, about six years ago, in their autumnal love season. At no other time, save their love season, twice a year, have I ever seen one chinch bug flying. It is quite remarkable that the winged imago, under no other circumstances, will even attempt to use its ample wings. No threatening danger, however imminent, whether of being driven over by grain-reapers wagons, or of being trodden under foot, &c., will prompt it to use its wings to escape. I have tried all imaginable ways to induce them to fly, as by threshing among them with bundles of rods or grass, by gathering them up and letting them fall from a height, &c., but they invariably refuse entirely to attempt to use their wings in escaping from danger. The love emotion alone makes them conscious that they are in possession of wings.

May 18th and 19th.—I find the chinch bugs very abundant in the fields of 1867.]

PROCEEDINGS OF THE ACADEMY OF

young spring wheat, barley, &c., under loose clods of earth, old cornstalks, and about the roots of the grain, in cracks of the ground, &c. In some badly affected fields a dozen or more to every wheat stalk.

May 26th.—The chinch bugs are just beginning to lay their eggs, and some fields of wheat are greatly damaged already from the feeding of the perfect insect. The stalk at the surface of the ground is black from their punctures, the sheaths of the outer leaves being scarred and dead; the tops are pale yellow, and often withering; many stalks are as dead and dry as hay. I saturated some saw dust with coal tar, and mixed some quick lime among it, so that it might be in a good condition for handling, and sowed it thickly broadcast over a portion of my wheat field where the bugs were very numerous.

May 27th—29th.—I find the chinch bug eggs more abundant, mostly on the roots and stalks beneath the ground, sometimes in loose clusters of a dozen or more. They are on the roots, where they cross the numerous cracks in the ground; less frequently on the stem, at the surface of the ground. These eggs are scarcely visible to the naked eye. Many of the bugs are in copulo, with their heads in opposite directions; the females are the larger, dragging the males when alarmed. The bugs refuse to leave the part of the field where I sowed the tarred sawdust, so there is but little hope of driving them from their once chosen grounds by the reasonable application of strong smelling drugs.

June 10th.—I saw the first larvæ chinch bugs of the season, small red fellows, on the roots; eggs very numerous. Actually saw a female laying an egg on my hand, under a slight pressure.

The egg is elongate ovate, about four times as long as wide (as nearly as I could determine with fine mathematical instruments $\cdot 04$ in. long and $\cdot 01$ in. wide; of course this lacks the precision of a micrometer measurement) pale amber white when first laid, but becoming of a reddish color, like the young, as the season of incubation advances. A moderate amount of moisture is necessary to the development of the egg. Those put into a pasteboard box in my room did not hatch, but shrivelled or dried up.

June 17th.—Millions of very small red young chinch bugs; they are on the roots, in crevices, and on the stems, under clods, &c., beneath the ground. The egg-laying season has terminated; the parent bugs are principally dead. Those that died before the rains a few days ago are mouldy; others, in great numbers, in many places covering the ground, apparently are just dead. During the past month, as I learned from many observations, they passed most of their time beneath the ground, in the crevices, &c., so that although millions of them existed in every field, a casual observer would believe that but a few were there. But their work being finished, they came out to die. A very few imago, scarcely one of a hundred, yet remain alive.

July 1st.—I ploughed a few acres of badly affected barley beneath the ground, to see what effect it would have upon the bugs, hoping that it might destroy them, and thus save the adjoining corn.

July 16th.—A farmer four miles from here informed me that a black coleopterous insect was destroying the chinch bugs on his farm very rapidly; and although I found his supposition to be an error, yet I found many dying on the low creek-bottom land from the effects of some disease, while they are yet in the larvæ state—a remarkable and rare phenomenon for insects thus in such a wholesale manner to be dying without attaining their maturity, and no insect enemy or other efficient cause to be observed capable of producing this important result.

July 22d.—Saw the first matured young chinch bug observed this year. Wings perfect, body pale reddish white, fresh from its last moulting. It is just 57 days from the time I saw the first egg, and 42 days since I saw the first larva.

[May,

On the low grounds the young chinch bugs are all dead from the disease above alluded to, and the same disease is spreading rapidly on the hills and high prairies.

The weather has been very wet since the first of July, and the barley above alluded to, which I ploughed beneath the ground, did not die, but assumed a yellow, sickly appearance; in its shady, compressed, unnatural position, the ends of the heads project from beneath the furrows. The chinch bugs also remained alive for a time, but feeding on the sickly grain and shaded from the sunlight, what little we had, were attacked by disease in the same manner and about the same time as those on the low creek-bottom lands, meeting very rapidly the same fate, so that very few of them ever found their way to the neighboring corn.

July 28th.—In the fields where 60 days ago I saw plenty of eggs, and 42 days ago an abundance of young chinch bugs, the imago are beginning to develop quite plentifully. Great numbers, in all stages of their development, are dying of the prevailing disease.

Aug. 8th.—The majority of the chinch bugs yet alive are in the imago state, but they are being rapidly destroyed by the prevailing epidemic disease, more fatal to them than the plague or Asiatic cholera ever was to man, more fatal than any recorded disease among men or animals since time began. Scarcely one in a thousand of the vast hosts of young bugs observed at the middle of June yet remain alive, but plenty of dead ones may be seen everywhere, lying on the ground, covered with the common mould of decomposing animal matter, and nothing else, even when examined by the microscope. Even of those that migrated to corn fields a few weeks ago, in such numbers as to cover the lower half of the corn stalks, very few are to be found remaining alive; but the ground around the base of the corn hills is almost literally covered with their mouldering, decomposing dead bodies. This is a matter so common as to be observed and often spoken of by farmers. They are dead everywhere, not lying on the ground alone, but sticking to the blades and stalks of corn in great numbers, in all stages of their development, larva, pupa and imago.

Aug. 22d.—It is almost impossible to find even a few cabinet specimens of chinch bugs alive, so that I am quite sorry that I did not secure a large supply of specimens while they were so numerous, in former years; for it really appears quite probable that even cabinet specimens will be hard to secure, whereby to remember the fallen race of the unnumbered millions of former years.

Sept. 13th.—After a whole day's searching in the corn fields, I have just been able to find two larvæ and a few imago chinch bugs, against the great numbers above alluded to in the corn about this time last year.

From this series of investigations I have learned that the parent chinch bug is occupied about 20 days in laying her eggs, during which time she probably lays about 500 eggs, and then dies; although careless observers and theorists suppose that she lays many more eggs, and that she continues to lay eggs all summer; also that the egg is about 15 days in hatching, that in from 57 to 60 days after the egg is laid the imago appears, and that there are *two* distinct broods in a season, and *only* two, notwithstanding the often promulgated opinions of theorists, from their very brief and imperfect and disconnected observations, about chinch bugs being many-brooded. The first brood matures from the middle of July to the middle of August, and the second late in autumn. The elder members of the first brood are 20 days in advance of the younger in their development, hence the former commence depositing their eggs for the autumn brood 20 days before the latter begin, hence the fall egg-laying season covers at least about forty days. This makes a difference of 40 days in the development of the second brood, and abundantly accounts for the fact that we
1867.]

see larvæ, pupa and imago promiscuously together, more especially towards autumn. It is also highly probable that none of the first brood survive the following winter, but that they all lay their eggs and die as does the spring brood. A close observer will, however, notice that of the parent bugs in the spring a very few may be seen among the larva and pupa of the spring brood. Quite probably they are such females as never mated nor fulfilled the great law of their being by propagation, and many of the males, for, like many other insects, the chinch bug lays its eggs and dies.

It is generally believed among entomologists that insect enemies are the most efficient means in nature for exterminating noxious insects; but in this remarkable fact in the history of insects, the great epidemic of 1865 (there can be no doubt about this being an epidemic disease, because the insects died without attaining their maturity), we find a greater enemy, the greatest insect enemy ever recorded, a dreadful "plague," that in a few days almost utterly annihilated a race of beings living in the northern part of the valley of the Mississippi, outnumbering all the human beings that have ever lived on this planet since the morning of Creation.

This disease among the chinch bugs was associated with the long-continued wet, cloudy, cool weather that prevailed during a greater portion of the period of their development, and doubtless was in a measure produced by deficient light, heat and electricity, combined with excessive humidity of the atmosphere, whereby an imperfect physical ("bug") organization was developed. The disease was at its maximum during the moist warm weather that followed the cold rains of June and the first part of July. The young chinch bug spent a great portion of its time on or near the ground, where its body was colder than the atmosphere; hence, upon philosophical principles, there must have been an excessive precipitation of watery vapor in the bronchial tubes. These are the facts in the case, but in the midst of the great obscurity that envelops epidemic diseases among men, it would be only idle speculation to attempt to define the cause more definitely than the physiological laws already observed seem to indicate. At all events it will require many years of warm dry summers, and accompanying winters of plenty of snow for protection, to reinstate the lost innumerable armies of this insect.

During the summer of 1866 the chinch bugs were very scarce in all the early spring, and up to near the harvest I was not able, with the most diligent search, to find one. At harvest I did succeed in finding a few in some localities.

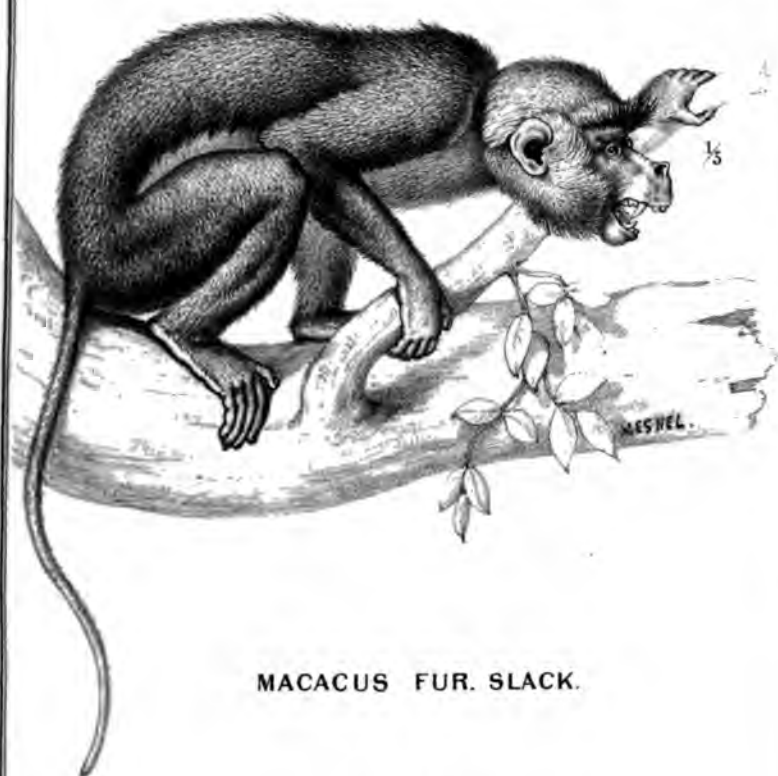
This epidemic disease was not confined to the chinch bug alone. During the summer of 1865 I saw the larvæ of the common striped cucumber bug (*Diabrotica vittata*) on the stems of melon and cucumber vines, above ground, a very unusual place for them. Always before this I have found them on the root, beneath the surface of the ground. This unusual position was evidently to escape the effect of some unnatural conditions. During the latter part of the summer of 1865 the imago were very much less numerous than common.

The apple-worm (the larva of *Carpocapsa (Tinea) pomonella* L.) was very numerous in 1863-4, affecting almost every apple. In 1865-6 they were very much less numerous. From observation I conclude that the disease was produced by the same cause that swept away the chinch bugs.

The potato-worm (*Sphinx quinque-maculatus*) was very numerous in 1864, doing much damage to tomatoes, &c. The pupæ were extremely abundant in the soil in the spring of 1865, but in autumn no observed larvæ had survived.

The *Locustæ* (grasshoppers) were also severely afflicted; the numerous dead, of all states, were easily seen everywhere, clasping the grass, weeds, &c., in the embrace of death. I might add much more of my observations on these insects, and greatly extend the list of afflicted species, but my object, to prove that epidemic diseases are incomparably the most important agents in all nature in destroying noxious insects, has been sufficiently illustrated. Neither is this a mere isolation, for I have observed diseases among various insects for the past 25 years.

[May,



MACACUS FUR. SLACK.



Descriptions of Five New Species of UNIONIDÆ and One PALUDINA of the United States.

BY ISAAC LEA.

UNIO BISSELIANUS.—Testa lævi, oblonga, sublenticulari, inæquilaterali, postice obtuso-angulata, antice rotunda; valvulis subcrassis, antice aliquanto crassioribus; natibus prominulis, ad apices concentrico-undulatis; epidermide tenebroso-oliva, obsolete radiata; dentibus cardinalibus crassiusculis, compressis, subelevatis crenulatisque; lateralibus sublongis, lamellatis subcurvisque; margarita carnea et valde iridescente.

Hab.—Bissel's Pond, Charlotte, N. C., C. M. Wheatley.

UNIO CLINCHENSIS.—Testa lævi, triangulari, ad latere planulata, valde inæquilaterali, postice obtuse angulata, antice rotunda; valvulis crassis, antice crassioribus; natibus prominentibus; epidermide luteola, ad latere radiata; dentibus cardinalibus crassis, subcompressis corrugatisque; lateralibus percrassis, curtis et obliquis; margarita alba et iridescente.

Hab.—Clinch River, Tenn., Pres. Estabrook, and French Broad River, Dr. Edgar.

UNIO JEWETTI.—Testa lævi, oblonga, subinflata, valde inæquilaterali, postice obtuse angulata, antice rotunda; valvulis subtenuis, natibus prominulis, ad apices concentrico-undulatis; epidermide fusca; dentibus cardinalibus parvis, obliquis, compressis; lateralibus, prælongis lamellatisque; margarita alba et iridescente.

Hab.—Florida, Col. Jewett.

MARGARITANA COLUMBENSIS.—Testa lævi, elliptica, valde inflata, subequilaterali, postice obtuse angulata, antice rotunda; valvulis tenuibus; natibus prominentibus, ad apices undulatis; epidermide luteola, obsolete radiata; dentibus cardinalibus parvis, sublobatis; margarita alba et aliquanto iridescente.

Hab.—Tombigbee River, near Columbus, Miss., W. Spillman, M. D.

ANODONTA YOCOCONENSIS.—Testa lævi, elliptica, valde inflata, valde inæquilaterali, postice subbiangulata, antice rotunda; valvulis subcrassis; natibus prominulis, aliquanto undulatis; epidermide tenebroso-fusca, radiata; margarita albidula.

Hab.—Head waters of the Youcon, Arctic America.

PALUDINA SPILLMANII.—Testa transverse exillissime striata, obtuse carinata, subelliptica, subtenui, imperforata; spira aliquanto exserta; suturis impressis, anfractibus quinis, subinflatis; apertura parviuscula, ovata, intus caruleo-alba; labro acuto, parum sinuoso; columella parum incrassata.

Hab.—Jackson Co., Alabama, W. Spillman, M. D.

Description of a New Genus of Plants.

BY ALPHONSO WOOD.

BREVOORTIA, nov. gen.

Perianthium corollaceum (coccineum), tubuliforme, supernè ventricosum fauce remissè contractà, regulare, persistens; limbo 6-partito, laciniis ovatis, obtusis, arcuè revolutis, sexies tubo brevioribus. Corona (flava) brevis, erecta, tribus squamis truncatis integris, bis latioribus quam longis, constituta. Stamina 3, squamas excedentia. Filamenta per totam longitudinem tubo adnata, interioribus laciniis opposita, ac cum squamis alternantia. Antheræ liberæ oblongo-lineares, extrorsæ, apice obtusæ, basi profundè bifidæ ibique insertæ. Ovarium liberum, ovatum, triloculare. Ovula in loculis 3—5, uniseriata. Stylus continuus, erectus, longitudine perianthii. Stigma capitatum, trilobatum. Capsula?

1867.]

Herba glabra, scapigera (bulbosa?). Folia 5—7, linearia, canaliculata, obtusa. Scapus teres, erectus, rigidus, 2—4 pedalis, longitudine foliorum. Flores 8—12, in apice scapi umbellati, unciales, nutantes, spathâ 4-valvi suffulti; pedicellis 1—2 polycaribus diffusis; bracteis ovato-lanceolatis, purpureis.

B. IDA-MAIA. Grows in deep rich soil on high hills of the Trinity Mt. Range, Shasta county, California, near the stage-road from Shasta City to Yreka. I saw it here in full bloom about the first of June, 1866, occupying a space of several acres. The leaves are very long and narrow, and recurved. The scape, although slender, is rigidly erect, of three, or even four feet high, round, smooth, wavy, and bearing at the top an umbel of about twelve scarlet or bright red flowers, nodding on their slender, recurved, unequal foot-stalks. The form of the perianth is between cylindric and pyriform, about one inch in length, with the limb very short, of six valvate lobes. Before opening, these lobes are chrome-green in color, making a peculiar contrast. After opening they are yellow. The three leaves (scales) constituting the corona are yellow, one line in length by two or three lines in breadth, occupying the place of, but in no wise resembling abortive stamens. Unfortunately I found no specimen in fruit; neither did I secure a bulb, so deeply buried were they, and so impatient of delay were my fellow passengers. The whole plant possesses singular grace and beauty, and few are better worthy of a place in the flower garden.

The new genus *Brevoortia* is nearly allied to *Brodiaea* (Smith), *Dichelostemma* (Kunth), *Stropholirion* (Torr.), &c., of the Natural Order Liliaceæ, tribe Asphodeleæ. All have the floral envelopes more or less united, with only three perfect stamens. Other three stamens (usual to the Liliaceæ) are variously transformed, as in the following Synopsis:

LEUCOCORYNE, three abortive filaments subulate or clavate.

BRODIAEA, three abortive filaments lanceolate-spatulate.

DICHELOSTEMMA, three abortive filaments petaloid, bifid,—a 3-lobed crown.

STROPHOLIRION, three abortive filaments petaloid, 2-parted,—a 6-lobed crown.

BREVOORTIA, three abortive filaments petaloid, entire, twice broader than long, truncate, with no semblance of stamens remaining. The perianth also wholly diverse in form from that of the four preceding.

This plant was first noticed by Mr. Burke, stage-driver, in his daily route, and by him my own attention was first called to it. He had given it the name of "*Ida May*, in affection for his little daughter,"—a name quite appropriate, moreover, as on the Ides (*i. e.* the 15th) of May, the plant begins to flower. Mr. Burke was confident that this was its only locality. Probably, however, it may yet be found in many other places in northern California.

We dedicate this genus to J. Carson Brevoort, of Brooklyn, a Regent of the University of the State of New York, himself an earnest naturalist, and a liberal patron of science.

June 4th.

The President, DR. HAYS, in the Chair.

Twenty-eight members present.

The death of Miss Margaretta H. Morris, member of the Academy, was announced.

June 11th.

The President, DR. HAYS, in the Chair.

Thirty-six members present.

[June,

The following was presented for publication :
 "On the Families of the Raniform Anura." By E. D. Cope.

June 18th.

MR. CASSIN, Vice-President, in the Chair.

Eleven members present.



Longitudinal section of Salisburia, showing wood cells of the first year's growth, with spiral ducts intervening between them and the pith.

Dr. H. C. Wood, Jr., called the attention of the Academy to the existence of true spiral ducts in the wood of *Salisburia adiantifolia*, a Japanese tree belonging to the Taxineæ, now extensively cultivated in Europe and this country, and remarkable for its leaves more closely resembling in general appearance those of some ferns than any exogen. He stated that, as far as he was aware of, ducts had not hitherto been found in any coniferous wood, and even in the *Salisburia* their position and arrangement were eminently peculiar,—different from those of the Angiosperms. The only layer of the wood in which they were produced was that formed during the first season of growth, all the other rings being composed simply of prosenchymatous cells, of the ordinary coniferous type. The medullary rays in the *Salisburia* are not continuous and well pronounced, but the points of the wood wedges formed during the first season are usually separated by well pronounced prolongations of the pith. It is in the extreme points of these wedges that the spiral ducts are situated, from three to six or even more deep. They are of small size, the largest scarcely exceeding the wood cells in diameter, the smallest scarcely one-third as large,—and contain some one, some two spiral fibres. The veins of the leaves are also composed largely of spiral ducts, but in these there is a strong tendency in the component cells of the vessel not fully to unite and be merged into one another; in many instances their end walls are not absorbed, so that each cell is distinct and perfect.

June 25th.

The President, DR. HAYS, in the Chair.

Thirty members present.

The Committee to which was referred the communication entitled:
 1867.]

"On the Families of the Raniform Anura," by E. D. Cope, reported in favor of its publication in the Journal.

The following letter was read from Mr. Geo. W. Tryon, Jr. :

DR. JOS. LEIDY :

Dear Sir,—A few weeks since I proposed to deposit my collection of Shells, &c., in the Museum of the Academy, subject to certain conditions. These conditions were, as I learn from the minute book, "unanimously agreed to," but they do not appear at length on the minute book, nor upon the record of Donations to the Museum, and my letter containing them appears to have been mislaid or lost.

I now repeat the conditions upon which I make the deposit of my shells, in order that they may be again acted on by the Academy and, if accepted, entered at length upon the minutes of the meeting.

1st. That all the species and varieties not now in the Academy's collection, as well as specimens from localities different from those now contained in it, shall be intercalated with the Academy's collection, but distinguished by their labels.

2d. That names of species representing authors' types shall never be changed.

3d. That the Academy will, immediately upon occupying its new Hall, provide a sufficient number of horizontal or table cases to display advantageously the entire collection ; the cases to be constructed so as to prevent the ingress of dust.

4th. I reserve the right to sell the duplicates as well as the cases in which my collection is now contained, for the purpose of augmenting, with the proceeds of such sale, the Conservators' Fund of the Conchological Section of the Academy.

5th. That the Conservators elected by the Conchological Section of the Academy, as well as the scientific Standing Committees of the said Section, shall have access to and control of the entire conchological collections of the Academy, subject to the supervision of its Curators.

6th. That none of the specimens deposited by me shall be loaned or removed from the custody of the Academy.

The deposit will never be withdrawn provided that the Academy shall faithfully observe the above conditions in every particular.

Yours, truly,

GEO. W. TRYON, JR.

The following gentlemen were elected members :

S. Morris Waln and B. Hammit.

The following were elected correspondents :

C. William Zaremba, St. Joseph's, Mich. ; H. E. Dresser, London ; M. H. Crosse, Paris ; Dr. Paul Fischer, Paris ; M. J. R. Bourguignat, Paris ; R. P. Montronzier, New Caledonia ; Geo. French Angas, Port Jackson ; Henry Adams, London ; Arthur Adams, London ; Dr. J. C. Chenu, Paris ; Hon. Edw. Chitty, Kingston, Jamaica ; J. B. Gassies, Bordeaux ; Sylvanus Hanley, London ; J. Gwyn Jeffreys, London ; Dr. H. C. Küster, Cassel ; Arthur Morelet, Dijon ; Dr. Louis Pfeiffer, Cassel ; Prof. O. A. L. Mörch, Copenhagen ; Prof. F. H. Troschel, Bonn ; G. S. Von Mohrenstern, Vienna ; Fred. Cailliaud, Nantes ; A. P. Server, Lyons ; Petit de la Saussaye, Paris ; Wesley Newcomb, M. D., Oakland, Cal. ; Dr. J. G. Cooper, San Francisco, Cal. ; R. E. C. Stearns, San Francisco, Cal. ; Prof. F. Poey, Havana ; Dr. J. Grundlach, Havana ; Dr. R. A. Philippi, Santiago, Chili ; H. Benson, Cheltenham, Eng. ; Henri Drouet, Troyes ; Dr. Auguste Baudon, Bauvais,

[June,

France; M. C. Recluz, Paris; Dr. Leon Vaillant, Paris; Baron de Castello de Paiva, Lisbon; Dr. G. Von dem Busch, Bremen; J. C. Cox, Sydney, N. S. Wales; Jules Mabille, Dinon, France; Luigi Benoit, Messina; J. Gonzales Hidalgo, Madrid; Abbe Joseph Stabile, Milan; M. Souverbie, Bordeaux.

Dr. Leidy remarked that the fine specimen of the cranial portion of a fossil ox skull, from St. Francisco, California, presented this evening by William M. Gabb, of the California Geological Survey, approached sufficiently near in size and form to the corresponding fragment of a skull from Big-bone-lick, Ken., referred to *Bison antiquus*, that it might be regarded as of the same species. Both probably belong to the female of *Bison latifrons*, as originally suggested in relation to the Big-bone-lick fragment. Prof. Rüttimeyer, who has ably investigated the geological history of the bovine family, reverses the reference of the fossils to the sexes, and regards the American forms as of the same species as the European *Bison priscus*.

The measurements of the cranial specimen presented this evening are as follows:

| | |
|--|---------|
| Distance between tips of horn cores..... | 3 feet. |
| Length of horn cores, following the lower curve..... | 14½ in. |
| Circumference at root of horn cores..... | 15 in. |
| Distance between roots of horn cores..... | 14 in. |
| Length frominion to naso-frontal suture..... | 13¾ in. |
| Depth ofinion..... | 8 in. |
| Breadth ofinion..... | 13 in. |

Prof. E. D. Cope called attention to a collection of reptiles from Owen's Valley, California, made and presented by Dr. Geo. H. Horn. He observed that they confirmed the conclusions derived from the study of the insects, that its fauna was that of the Colorado Region, or the Sonoran district. Characteristic species were *Spea bombifrons* Cope, *Coleonyx variegatus* Baird, *Rhinoceros lecontei* Bd. Gird., *Caudisoma cerastes* Hallowell, and a new *Chilomeniscus* Cope, which was called *C. ephippicus*, with the following characters:

Scales broad, in thirteen rows; tail about one-seventh total length. Rostral plate large, entirely separating internasals, not encroaching on prefrontals; nasal plate separating prefrontals and labials, in contact with preocular. Postoculars two, upper only in contact with occipital. Superciliaries very narrow, occipitals broad as long. Temporals ½, large; labials above, seven, third and fourth in orbit, these with second, narrow erect; first longitudinal; fifth and sixth smaller than the others, seventh suddenly larger. Inferior labials eight, first pair in contact before pregenials; postgenials very small.

Total length five and one-half inches. Gastrosteges 113, separated from genials by four rows gulars; anal 1—1; urosteges 28—28. Above reddish or yellowish, with twenty-one black cross-bars to vent, which are broader than interspaces, and do not quite reach gastrosteges; five nearly complete rings on tail. Belly white. From occipitals to anterior part frontal with the labials opposite this part (except their lower edges) black.

This species is somewhat similar to the *C. cinctus* Cope, from Sonora, but differs in many details, and in not being annulate.

He also stated that *Scaphiopus holbrookii* had appeared abundantly in a pond over a mile west of the falls of the Schuylkill. They were the first he had noticed in this neighborhood, though John Cassin had seen them previously in Delaware county.

The speaker also made some remarks respecting the origin of species, stating that the genera of tree frogs *Hyla*, *Scytotis*, *Osteocephalus* and *Trachycephalus* form a natural series, measured by the relative degree of ossification of the
1867.]

cranium. He stated that individuals of *Trachycephalus* first belong to the genus *Hyla*, subsequently to *Scytotis*, later to *Osteocephalus*, and finally to *Trachycephalus*, and that no additional characters existed at any of these stages, to render such references inexact. He said that the characters of the inferior genera might be regarded in one sense as larval, and that as the genus *Siredon* had passed into *Amblystoma* by loss of larval characters, there was no reason why the preceding genera might not, under suitable circumstances, do the same, respectively. He said also that the specific characters were recognizable while the *Trachycephalus* exhibited the generic type of *Hyla* and others, suggesting that the specific characters might be more permanent than the generic. A similar case recorded by Agassiz was mentioned,—that of *Chelopus guttatus*, where the yellow spots appear before it has lungs or its family characters.

July 2d.

The President, DR. HAYS, in the Chair.

Twenty-four members present.

July 9th.

The President, DR. HAYS, in the Chair.

Eighteen members present.

Dr. Genth made some observations on certain doubtful minerals which he had lately examined. *Barnhardtite*, the peculiar copper ore which stands between *Chalcopyrite* and *Variegated Copper Ore*, occurs amongst the ores of Bill Williams Fork, Arizona.

From the same locality he observed *Brochantite*, both in foliated masses and small but brilliant crystals. A former pupil of his, Mr. N. S. Higgins, received in Arizona an *Arsenide of Copper*, the nature of which he did not fully ascertain, which proved to be the interesting species *Whitneyite*, of which we have now four localities: two on Lake Superior, one in Chili, and the last at La Lagoona, a rancho near the town of Saric, Sonora.

The *Tellurides* from Melones appear to be three distinct species. One seems to be principally *Telluride of Silver*, with some *Telluride of Gold*—probably auriferous *Hessite*. The second is a combination of *Telluride of Silver and Lead*; the third, and most interesting of all, is *Telluride of Nickel*, which he calls *Melonite*. This is the first time that a combination of Tellurium and Nickel has been observed. It has a reddish-white color, almost exactly like that of Bismuth, and a granular and foliated structure. The three *Tellurides* are associated with native Gold, Quartz, Pyrites, *Chalcopyrite*, *Calcite*, etc., and it is almost impossible to obtain pure material for analysis.

From several of the mines in Humboldt County, Nevada, he has noticed a mineral with the aspect of *Aikinite* or *Needle Ore*, with the examination of which he is at present engaged.

July 16th.

MR. VAUX, Vice-President, in the Chair.

Sixteen members present.

July 23d.

DR. BRIDGES in the Chair.

Eighteen members present.

[July,

July 30th.

MR. VAUX, Vice-President, in the Chair.

Sixteen members present.

The following was presented for publication :

"Notes on certain Birds from New Grenada, with Descriptions of New Species." By Geo. N. Lawrence.

The following gentlemen were elected members :

Henry C. Gibson, Chas. Gibson, Andrew M. Moore, John Gibson and T. Brantly Langdon.

On favorable report of the Committee, the following paper was ordered to be published :

The Necessity and Velocity of Nebular Rotation.

BY J. ENNIS.

If matter were universally diffused through all space, the supposition would not be in accordance with experience, that this diffusion would be perfectly uniform and even. Such is not the result of natural processes in the actual world. The waters of the ocean are not perfectly uniform ; their densities being varied by temperature and saline ingredients. The air is not uniform, nor the vapor of water in the air. Therefore, if matter were universally diffused, and contraction were to ensue, then the rarer portions would gather around the denser, and the expanded vapor would break up into separate huge irregular masses, like the clouds when the vapor of the atmosphere is contracting.

On the surfaces of these separate nebulous masses we can conceive of four sources of motion ; the first only hypothetical, and the other three absolutely necessary.

First source of motion. In this general diffusion of matter, the supposition would be unnatural that all was perfectly motionless and still. A state of absolute repose might, for aught we know, be possible, but it would be a strange and unheard of assumption. How unlikely that the causes which spread matter abroad so widely should stop entirely, and leave no motion ! Therefore every nebula in its beginning was probably endowed with some movements.

Second source of motion. When separate nebulous masses were formed by the ordinary principles of contraction and condensation, we cannot suppose they would be stationed at equal and symmetrical distances from one another, any more than we see among the white clouds which float together across the clear blue sky. Neither would they be of equal size, for the heavenly bodies, like the clouds, are very unequal in size. Therefore, by the force of gravity, the smaller would fall into the larger ; and often two or three near together, though of similar size, would fall into one another. But any one could never fall directly toward the centre of gravity of another ; because every approaching pair would be more or less under the influence of other neighboring nebulae. Therefore, in striking each other obliquely, and not in the direction of their centres of gravity, a rotation must result. These collisions must have been a thousand times more numerous than the fall of meteors now, and so they would continue until space became cleared of all small and neighboring masses, and nothing remained but large and vastly distant nebulae, each one of which is now represented by a great STELLAR SYSTEM, containing countless numbers of fixed stars.

Third source of motion. By the assumption of the nebular theory, as understood by myself, the contraction of a nebula was always much more slow than would be due to gravity. Therefore gravity would make the nebula round, 1867.]

and the irregular projections, perhaps long arms, would slide down laterally in the neighboring depressions. By this process many horizontal currents would be produced on the surface.

Fourth source of motion. These irregular projections, perhaps great extended arms but little attached to the nebulae, would be under the influence of neighboring nebulae similar to tidal influence and stellar perturbation, especially while the nebulae were still near to one another, though contracting steadily to greater distances. Therefore the fall of these irregular prominences into the larger mass would be somewhat like the falling together of two independent nebulae. They would not fall towards the centre of gravity of the principal mass, but more or less obliquely, and hence they would lead to rotatory motion.

From these four sources of motion many currents would flow *on the surface*, at least, of every nebula. In those cases where two large nebulae fell into each other, the currents would pervade the entire mass. But even when the currents were superficial only, they could not stop; because, on account of the continued contraction of the nebula, they would flow in the direction of an inclined plane. With their horizontal motion they would have an inclined motion towards the centre, and gravity would hasten them downward. These currents would act and react on one another, and by well known mechanical principles they would all result in a single current, as we see by experiment in a basin or funnel of water. This one current would be around the centre of gravity, and, for the same reason, it could not cease to flow. In consequence of the continued contraction of the nebula, every particle of the surface current is moving in the direction of an inclined plane, and gravity must give them the velocity due to inclined plane motion. If they be retarded by friction on the unrotating or slowly rotating interior, then this interior will be moved in the same direction, and gravity will carry it onward until the entire nebula rotates. As the nebula contracts from the extent of its original round form down to near its centre, *every particle must acquire a velocity equal to that of a fall from its original to its last extent*, excepting only the retardation due to friction. This is one of the most essential ideas in the nebular theory originated by myself, and demands a complete illustration.

Every body approaching toward the centre of the sun, whether directly or obliquely, must be hastened by the force of gravity. The celebrated Halley's comet, for instance, which requires about seventy-six years to go around its orbit, is beyond the distance of Neptune when it reaches its aphelion; then the moment it passes its aphelion, and begins its return toward the sun, it begins to be hastened on its course by gravity. So it continues to be hastened by that force every hour faster and faster, during thirty-eight years. Being free to move, and unobstructed, it runs in a conic section, and when it arrives at perihelion its velocity has become so great as to have a centrifugal stronger than its centripetal force. Therefore it shoots away from the sun again, but every hour in its departure its velocity is delayed by gravity. Thus the proposition is certain that when a body departs from the sun its velocity is retarded, and when it approaches the sun its velocity is accelerated, by gravity. Every particle in a current on the surface of a contracting nebula is moving obliquely, like a comet, towards the centre of the nebulous sun, and therefore they must all be hurried along by gravity.

Halley's comet, while descending from aphelion to perihelion, may be regarded as moving down a spiral inclined plane. Its ultimate velocity will be the same as if it had fallen to the sun through the height of the plane, plus its initial velocity at aphelion. That is, its ultimate velocity will be the same as if it had fallen from aphelion in a direct radial line until a distance from the sun equal to its perihelion, plus its initial velocity at aphelion. In the same manner a particle, while descending in its spiral current towards the centre of the nebulous sun, must at any point in its course have the same velocity, friction excepted, as if it had fallen in a direct radial line to that point, plus the

[July,

initial velocity which it acquired in the rounding process. I have found by calculation that this velocity may be so great as to give all the zone on the nebular equator a centrifugal force equal to the centripetal force. Therefore a period may arrive in the contraction of a nebula, when the equatorial zone can no longer approach towards the centre, but must be abandoned as a ring circulating around the nebula, until by perturbation it is broken, and subsides by gravity into a rotating nebulous planet. Friction, however, in the cases of some nebulae, may be so powerful as to retard the velocity, and prevent the separation of matter in the form of a ring.

There are some points of difference between a comet and a particle on a rotating equatorial zone. A comet, in departing from the sun, is deprived by gravity of all that velocity which, in approaching the sun, was imparted by gravity. A nebulous particle does not fly off from the centre like a comet when departing from perihelion, because it does not run in a conic section; and it cannot pursue a conic section on account of friction, which retards its motion, and also on account of atomic repulsion in the nebulous mass, which forces it outside of the elliptic curve on the way towards perihelion. The spiral course of the nebulous particle, from the slowness of nebular contraction, is nearly circular, and hence, when the centrifugal equals the centripetal force, the particle takes nearly a circular orbit. Hence, as it always approaches the centre of the nebulous mass, it always receives velocity from gravity. And when it ceases to approach, it never flies far off, and therefore never loses velocity from gravity, as does the comet.

Gravity could cause no rotation, unless a particle on the surface had first a horizontal motion given in the process of rounding the nebula, and unless the nebula contracted. By this horizontal motion and by contraction, the particle approaches the centre of the nebulous sun obliquely, and gravity hastens it down the inclined path. The particle cannot stop, because there is nothing to make it stop. Repulsion cannot stop it, because repulsion, like centrifugal force, is *every instant yielding before it*, and allowing it to retain all its actual motion, and to acquire more motion *by a full every instant* towards the centre. If it be delayed in its velocity by friction on other particles, then just so much momentum must be imparted to them, and they too will move in the direction of an inclined plane towards the centre, and these again will move other particles, and so on until the entire mass moves and rotates. If the particle had no horizontal motion, then repulsion and gravity would act upon it in opposite directions, and it would partake only of the general contraction in radial lines towards the centre. There could be no rotation. But by its horizontal motion, and by the slow contraction of the mass,—slower than is due to gravity,—the particle finds the path before it every instant settling down. Hence *every instant it goes down as it goes forward*, and its motion is in the direction of an inclined plane, and subject to the inclined plane law of increased velocity; that is, a velocity equal to that of a fall through the height of the plane.

Imagine a circle, the equatorial section of a nebulous globe, with a million of radii. Then the particle with a horizontal motion finds at each succeeding radius that the surface, by contraction, has gone down towards the centre. It must, through gravity, follow that surface downward. Every instant, therefore, it receives a new impulse down its course,—a million of impulses in one revolution. Then, with no impulse in the contrary direction, its velocity must increase.

By calculating the velocity of the equatorial zone of our sun down an inclined plane as due to gravity, I ascertained the velocity of rotation of our sun when in a nebulous condition, and found that it precisely equalled, at different stages of its contraction, the present velocities of the planets and asteroids when an infinitesimally small allowance is made for an inevitable friction on the unrotating or slowly rotating interior. These small allowances due to friction are given in my recent volume, "The Origin of the Stars." In that volume also the rotations of the several nebulous planets are shown to have

been the same as the present revolutions of their satellites; and the reason is pointed out why the smaller planets could have no satellites. By these and by many other coincidences the discovery was first made that GRAVITY IS THE FORCE WHICH IMPARTED ALL THEIR MOTIONS TO ALL THE STARS.

It is proper now to attend to three objections which, on account of the present state of astronomical science, naturally rise against this view of the necessity and velocity of nebular rotation.

The first objection is that this view "contravenes the principle of conservation of areas." The fallacy of this objection may be seen by a very simple arithmetical calculation. We will take Mercury, whose radius vector moves most rapidly, and at the rate of 110,000 per hour. Neptune is about eighty times farther from the sun. The original extent of our nebulous sun was half-way to the nearest fixed star; say 3,622 times farther than Neptune, and consequently, in round numbers, $3622 \times 80 = 290,000$ times farther than Mercury. The area described by the radius vector of Mercury in one hour equals that radius multiplied by half its distance per hour, say $1 \times 110,000 \div 2$. The area described by the radius vector of the original nebulous sun must have equalled that radius multiplied by half its distance per hour, say $290,000 \times x \div 2$. Both these areas must be equal. Now what must be the value of x that, when multiplied by 290,000, gives 110,000? Plainly $\frac{11}{29}$, or $\frac{1}{2.6}$ nearly; that is, the movement of the radius vector of the original nebulous sun, or, in other words, its primary rotation, was about one-third of a mile per hour. I will soon point out how this velocity was obtained.

The second objection is drawn from a misapplication of the principle that action and reaction are equal, and in opposite directions. By this principle, when an object falls to the earth, the earth falls proportionally to the object; when we walk forward in a straight line, we push the earth backward proportionally; when a car, by gravity, runs down an inclined plane, the earth as well as the plane moves proportionally in the opposite direction: that is, both upward and backward. Therefore it has been wrongly inferred that when a particle, or all the particles, on the rotating exterior of a contracting nebula move by gravity in the direction of an inclined plane toward the centre, then the interior should move proportionally just the contrary way. It has been wrongly inferred that these two opposite motions should counterbalance each other, that in fact there can be no such operation, that the whole idea is like "the old absurdity of a perpetual motion, or of a man trying to lift himself up by pulling at the straps of his boots."

But all such inferences show a misunderstanding of the case. We must learn to see the difference between moving in the direction of an inclined plane, and moving on an actual inclined plane. A comet or a planet approaching perihelion is moving in the direction of an inclined plane. With its forward motion in its orbit it has an inclined motion towards the sun, and its velocity is hastened by gravity in consequence of this inclination. Imagine a hundred comets all in the plane of the sun's equator, and equally distributed around the sun, and all approaching their perihelion. While all would be accelerated by gravity toward the sun, the sun would not be moved in any way towards them, because it would be equally acted on all around by the comets. Neither could there be any reaction to make the sun rotate in the opposite direction, because there is no actual inclined plane to cause a backward motion. The comets have the inclined plane motion without an inclined plane. In the same manner on the horizontal equatorial zone of a rotating and contracting nebula, all the particles move in the direction of an inclined plane spirally coiled many times around, and all are hastened by gravity according to the law of velocity on such a plane, but not one of them moves down an actual inclined plane. THEY ALL REPOSE ON A LEVEL OR HORIZONTAL SURFACE! therefore they do not move the interior backward while they move forward. If they were on an actual inclined plane they would create a coun-

[July,

ter movement. But such is not the case. Each one, while approaching the centre, draws the entire mass up towards itself, as when a fly alights on the earth, but being equally distributed all around, they counteract one another's efforts in this regard, and produce no result. The reason why there is a backward reaction on a real inclined plane is simply because of the inclination of the surface. An object cannot repose quietly on such a surface. The forward motion of the object must give a backward push to the surface. But when there is no inclined surface, as on an equatorial zone, there can be nothing against which a backward push can be made by mere gravity.

In its approach toward perihelion a comet is upheld from falling in a straight line toward the sun by centrifugal force; that is, its plane is sustained by centrifugal force. In like manner, on the equatorial zone of a rotating and contracting nebula, a particle is upheld from falling straight toward the sun's centre, partly by centrifugal force and partly by atomic repulsion; that is, its plane is upheld partly by centrifugal force and partly by repulsion. But neither of these hinders the force of gravity from imparting every instant an increased velocity in the inclined plane direction. Both repulsion and centrifugal force are constantly yielding before the power of gravity, and allowing the comet or the particle to be accelerated. In this way inclined plane direction and increasing velocity are produced without an actual inclined plane, and hence one of the reactions of an inclined plane is wanting: namely, the backward reaction. The other reaction—the upward—is nullified by opposite particles on opposite sides of the nebula.

Atomic repulsion has two effects different from mere centrifugal force; it hinders the moving particle from following an elliptic orbit, and it causes retardation by friction. But the direction of its action is always in a radial line, always perpendicular to the nebular surface on which the particle quietly reposes; and it yields every instant like centrifugal force before the power of gravity, which continually brings the particle toward the centre. In the beginning of nebular rotation, and when that rotation is very slow, a particle on the exterior presses with nearly all its weight on the interior. It is then upheld very little by centrifugal force, and chiefly by repulsion. As it moves more rapidly it acquires greater centrifugal force, and presses less heavily on the interior. It becomes hourly less and less upheld by repulsion, and more and more by centrifugal force. At length it is held up entirely by centrifugal force, and presses no more on the interior. It is independent of repulsion; it circulates freely around the centre, without approaching it. The centripetal and the centrifugal forces are equal.

An important illustration may be made with a funnel to show that a fluid may move down the direction of an inclined plane without producing the backward reaction of such a plane. Suspend the funnel by a single small silk braid, having no twist. Pour in the water, and give a portion a horizontal motion. Give the funnel an equal impulse in the opposite direction. The water, as it runs through the funnel, will rotate, and evidently every particle of the water will run an inclined plane direction, but the plane must necessarily take the form of a coil. According to the principle of the backward reaction on an actual inclined plane, the natural expectation would be to see the funnel rotate in the direction contrary to that of the water. But this does not occur. On the other hand, the water, by friction, carries the funnel around in the same direction with itself. In like manner the exterior of a nebula must carry along the unrotating interior with its own motion. The reason is the same in both cases. There is no backward reaction, because in both cases the particles, as they move, REPOSE ON A HORIZONTAL SURFACE. They do not move down an actual inclined surface, and hence cannot react according to the law of an inclined plane surface. They have the law of velocity, but not the law of backward reaction. This absence of the backward, though not of the upward, reaction, may be regarded as a new dynamical principle. It has not before been detected in the funnel problem, nor in the nebular theory, nor in aught else that I am aware.

1867.]

The third and last objection is that gravity cannot cause nebular rotation, and that it cannot therefore be the force which imparted their present motions to the stars. We have already seen that if, on the surface of the nebula which formed our solar system, there had been a movement of rotation only about one-third or one-half a mile per hour, then gravity, acting by the law of conservation of areas, would have imparted the velocity of 110,000 miles per hour to Mercury. But how could this nebula have received a rotation of half a mile per hour? This question is easily answered by following the logical consequences of the nebular theory, aided by well known facts in astronomy. The fixed stars have velocities at least equal to the planets. When they were all in a nebulous condition, just broken up from the vast nebulous disk stretching all around within the Milky Way, they must have been irregular in form, quite near to one another, and *endowed with their present rapid velocities*. Then, by their mutual perturbations, they must have imparted motions to one another's irregular exteriors.

The power of perturbation between the fixed stars is much stronger than has been suspected by astronomers. In "The Origin of the Stars" I have shown that the sun's gravity on Alpha Centauri is now so powerful that that star must move more than 2,000 miles per day at right angles to its present direction from ourselves, to gain a centrifugal force sufficient to avoid falling into the sun. Estimating the masses of the stars from the amounts of their light and their distances, then the power of gravity from Alpha Centauri alone on our sun is so great that our sun must move more than 5300 miles per day to avoid falling into that star; and for the same reason our sun must fly with a velocity of more than 13,000 miles per day to avoid falling into Sirius. When these stars were in their nebulous conditions, expanded nearly to one another, irregular in shape, and moving past one another with their present astonishing velocities, their mutual power for moving currents on their irregular surfaces must have been very strong. Moreover, they must have had the same liability to fall into one another, and thus to produce rotation as the original stellar nebulae.

We can also readily conceive how, in the very first formation of the several solar nebulae, and flying along with inconceivable rapidity, their irregular projections may not have had precisely the same motions as the centre of gravity. From all these causes we can understand how, after the rounding process, a motion of half a mile per hour may have been given to the one resultant current on their surfaces.

But whence the proper motions of the fixed stars? or rather, whence the proper motions of the nebulae from which the fixed stars were formed? The nebular theory gives the same cause for the forms and the motions of the stellar systems as of our solar system. That theory points to a great original nebula, whose rotations by the force of gravity formed and moved the ring of the Milky Way, and its interior disk, and its scattered exterior clusters. Gravity, in causing this rotation and the proper motions of the fixed stars, must have acted by the law of conservation of areas; and now we must inquire how much motion, according to that law, was necessary on the surface of our original stellar nebula? If half a mile per hour was sufficient for our solar system, how much was necessary for our stellar system? On the supposition that the stellar motions are as rapid as the planetary, and that the force of gravity was equally strong in both, then the original surface motions of our solar and stellar nebulae must have been to each other in some proportion inversely as the lengths of their radii. But as the length of the stellar radius was almost infinitely longer than that of the solar radius, so the original motion on the surface of the stellar nebula must have been almost infinitely slower than on the surface of the solar nebula; that is, almost infinitely slower than half a mile per hour!

But whence these very slow motions on the surfaces of the original stellar nebulae? These I have already given in the four sources of motion in the beginning of this paper.

[July,

In our solar nebula the areas described by the radius vector diminished very slowly, on account of the very slight friction, which also retarded the velocities of the planets, as I have shown in Section 19th.

August 6th.

MR. CASSIN, Vice-President, in the Chair.

Nineteen members present.

Dr. H. C. Wood, Jr., called the attention of the Academy for a few minutes to some observations on the life history of some of our siphonaceous fresh water algae.

He stated that the accounts of the method of the production of the zoospores of the ordinary *Achlya prolifera*, as given by Henfrey and Carpenter, differed very essentially. The former states that the zoospores do not directly appear in the filaments, but that in the original zoosporangium are formed only *daughter cells* by the aggregation of nitrogenous protoplasm, which daughter cells are incapable of spontaneous motion, are unprovided with cilia, and are emitted apparently by being, as it were, forced out by endosmotic pressure excited through the zoosporangium. After emission, according to Henfrey, they remain clustered at the end of the filament, and in a few hours each daughter cell gives origin to a single zoospore, which is formed from the whole of its protoplasmic contents. According to Carpenter, the zoospores are formed directly in the zoosporangium, are then furnished with cilia, and escape by means of their own motile power. Dr. Wood stated that his own observations on the plant entirely corroborate and coincide with the results arrived at by the lamented Henfrey, and that he had frequently seen the very delicate cellulose coats of the daughter cells still aggregated around the distal end of the zoosporangium after the escape of the zoospores from them. Dr. Wood further called the attention of the members to the existence of several algoid forms growing in the neighborhood of the city, which were closely allied to *Achlya prolifera*, but in some respects quite distinct from it. In one of these, which appears to be at least generically the same as the former species, the Doctor stated he had studied the formation of *resting* spores, which takes place in a way similar to that seen in other of the Siphonaceæ, such as the *Vaucheria*. At the distal end of a filament about to form resting spores a roundish bulb-like enlargement takes place, which soon is crowded with nitrogenous protoplasm derived from the main filament, from which it is in a little while shut off by a delicate membranous partition. About this time, just below such sporangium, there appears a process very similar to that seen in the *Vaucheria*, which process finally comes in contact with the sporangium, between which and itself a communication is soon established. The contents of the sporange now contract themselves into a globular ball, and develop into the resting spore.

If these views and observations hereafter should be confirmed, they would settle the doubt expressed by many authorities, whether the *Achlya* be not merely a submerged fungus, altered by this very submersion so as to resemble an algoid growth; for if species of the genus are found whose whole life history is similar to that of others of the Siphonaceæ, even to the formation of resting spores by a kind of conjugation, it seems indisputable that the organisms under consideration are perfect entities, not merely degraded forms of higher plants. Further, granting the facts stated, if one of the Siphonaceæ is a fungoid growth, surely all the others must be; and it does not seem probable that the *Vaucheria*, with its green endochrome, is a fungoid growth.

Dr. Leidy mentioned the recent appearance of the seventeen year locust in Montgomery, Wythe and other counties of Virginia.
1867.]

August 13th.

The President, DR. HAYS, in the Chair.

Nineteen members present.

The following was presented for publication :

"Additional Notes on male forms of *Vitis vinifera*." By T. Meehan.

By permission, the Committee reported in favor of publishing the following paper, which was so ordered :

Notes on certain BIRDS from New Granada, with descriptions of New Species.

BY GEO. N. LAWRENCE.

TACHYPHONUS PROPINQUUS.

Tachyphonus rubrifrons, Lawr., Proc. Acad. Sci. Phil. 1865, p. 106.

In a conversation with Mr. McLeannan concerning the red on the forehead of the male in this species, he said the sexes were alike in plumage, and suggested that the color might be a stain caused by its feeding on some kind of fruit ; on examination with a glass, it is quite apparent that the color is due to such a cause,—the pulp, probably of some kind of fruit, still adhering to the feathers.

The first name, therefore, being inappropriate, I propose in place of it that of *propinquus*, from its near relationship to *T. xanthopygius*.

2. PHÆNICOTHAUPIS VINACEA.

Male.—Crest scarlet, distinctly bordered on each side with a line of blackish feathers ; the entire upper plumage besides, including the tail, is of a dark vinaceous red ; the quills have their inner webs blackish-brown, the outer are the color of the back, but brighter, as are also the outer margins of the rectrices ; the under plumage is likewise dark vinaceous, but lighter than the back, with the throat clearer in color, but not so decidedly as in all the other allied species, except *P. rubica*, in which the entire under plumage is quite dull ; the upper mandible is black, the under brown ; tarsi and toes reddish-brown.

Length about 6½ in. ; wing 3½ ; tail 3½ ; bill 9-16ths ; tarsi 7.

Habitat.—New Granada, line of the Panama Railroad.

Remarks.—I have had this specimen for some years, and considered it different from any of its affines ; in its upper plumage it comes nearest to *P. rubica*, but the color is deeper and clearer, the sides of the head are not dusky as in that species, in the coloring below they are not at all alike, *rubica* being of a dull brownish-red, with but little brightness even on the throat, whereas the other is of quite a clear color throughout ; *rubra*, *rubicoides* and *fuscicauda* have their throats much lighter and brighter in color ; it is smaller than any of the others except *rubra*, from which it scarcely differs in size ; they are also much alike in their upper plumage, but *rubra* has the rump and tail brighter, and below is much paler in color, being the most so of any of the group. Its deep and nearly uniform color will distinguish it from all the others.

In an article by Mr. O. Salvin (Proc. Zool. Soc. London, 1867), "On some Collections of Birds from Veragua," he refers a bird to *P. rubica* with a question, of which he has several specimens ; from his remarks I should judge it to be the same as the above described species.

3. LEPTOPTILA CASSINI.

Leptoptila verreauxi, Cass., Proc. Acad. Sci. Phil. 1860, p. 195.

Leptoptila verreauxi, Lawr., Annals Lyc. N. Y. vol. vii. p. 333.

Male.—Forward part of the crown and front bluish-white, paler next the bill ; hind part of crown and nape, back, wings and central tail feathers, of a

[August,

dark greenish olive-brown, washed on the upper part of the back with vinaceous; the lateral tail feathers are purplish-black, the outer two on each side marked with grayish-white at their ends; quills dark brown, tinged with purple, the inner margins for two-thirds their length from the base pale dull cinnamon; lining of wings and axillars deep cinnamon; a band on the hind neck, of bluish ash, connecting with the same color on the breast; the lower part and sides of the neck are of a paler bluish-ash; chin and throat white; the sides are dark olive-brown; upper part of abdomen of a pale vinaceous, the lower part nearly white, just tinged with the color of the upper part; feathers over the thighs filamentous, and of a grayish-white color, as are also those of the vent; under tail coverts brown, with their ends white; bill black; "irides yellow;" tarsi and toes fleshy yellow.

Length (fresh) $10\frac{3}{4}$ in.; wing $5\frac{1}{4}$; tail $3\frac{5}{8}$; bill $\frac{5}{8}$; tarsi 1 3-16ths.

The female does not differ materially from the male.

Habitat.—New Granada. Line of the Panama Railroad.

Remarks.—This species was referred to *L. verreauxi* by Mr. Cassin, in his "Catalogue of Birds from the Isthmus of Darien," and by myself in "Catalogue of Birds from New Granada," &c. Since then I received from Mr. McLeannan a specimen of another species, which I determined to be the true *L. verreauxi*, Bp.; on a recent visit to Boston I was able to verify it as being so, by comparison with that species in the Lafresnaye collection, now the property of the Boston Natural History Society, the liberal gift of the late Dr. Henry Bryant.

L. verreauxi is above of a lighter and more decided olive, the outer three tail feathers on each side end more largely in white, the under plumage is much lighter and very different in color, the neck and upper part of the breast being of a light vinaceous rose color, gradually merging into white on the abdomen; the under tail coverts are entirely white.

The two species are very different in appearance, that of *cassinii* being very dark, whereas the colors of *verreauxi* are comparatively light.

I have conferred the name of my friend Mr. John Cassin on this fine species.

In the Museum of the Smithsonian Institution are specimens from Costa Rica, as well as those from the Atrato in Lt. Michler's collection.

Mr. John Galbraith, in his notes sent with the collection made for me on the line of the Panama Railroad, states that it is "common, but shy."

August 20th.

The President, DR. HAYS, in the Chair.

Nineteen members present.

August 27th.

MR. VAUX, Vice President, in the Chair.

Sixteen members present.

The following gentlemen were elected members:

Dr. J. K. Tyson, Dr. W. Pepper, Dr. Geo. Pepper, Dr. Horace Binney Hare and Elias D. Kennedy.

The following were elected correspondents:

Geo. J. Durham, Austin, Texas; John Henry Gurney, Norfolk, Eng; Osbert Salvin, London; T. C. Jerdon, M. D., Madras, India; and Prof. J. Reinhardt, Copenhagen.

Prof. Cope communicated by letter the following description of a new genus of Cyprinoid fishes from Virginia:

Among the Cyprinidæ of the Kanawha River, at Eggleston's Springs, one appeared to be of sufficient interest to mention to the Academy. I took but 1867.]

two specimens, supposing them to be the young of some species of *Catostomus* or sucker. The size of the scales shows that it does not pertain to any species known in this region, and I was, therefore, induced to examine the pharyngeal teeth and alimentary canal. I found, to my surprise, that they were both of the carnivorous type, showing the form and position of the mouth to be deceptive, though they are frequently coördinated parts. The genus and species appearing to have hitherto escaped observation.

PHENACOBIOUS Cope. Pharyngeal teeth 4—4, uncinat raptatory, sharp edged; alimentary canal not longer than head and body; dorsal fin above the ventrals; scales normal, lateral line complete; mouth very small, inferior, maxillary arch projectile, covered by a thick fleshy lip, which is enlarged posteriorly and behind mandible; no barbels; mandible naked, included. Aspect of *Catostomus*. Name from *deus*, deceptive, and *bios*, life.

Phenacobius teretulus Cope, sp. nov.

Head stout, $4\frac{1}{2}$ times in total length, exclusive of caudal fin, equal depth at dorsal fin; orbit 3.5 in length of former, its superior rim on frontal plane. Pre-orbital bone elongate parallelogrammic. Muzzle elongate, decurved obtuse, heavy. Canthus of mouth opposite middle of o. præorbitale; supra-opercular region rounded; isthmus wide; form moderate, caudal peduncle not attenuated. Scales with coarse concentric lines and radii; 6—43—5; thoracic region scaled. Pectoral fin not reaching ventrals, nor ventrals the anal. Dorsal narrow, elevated; caudal deeply forked; radii D. 1. 8: C. +18+ : A. 7: V. 1. 8: P. 17. Total length of specimen 3 in. 6.5 l. Above pale olive yellow, the scales faintly edged with black; below silvery; end of muzzle and band on each side to orbit blackish; a leaden band on each side on middle line from behind ventrals to base of caudal, which is occasionally broken into spots.

The affinities of this fish appear to be to *Ceratichthys*; its habits and food are probably similar; as in that genus the natatory bladder is largely developed. Its habitat appears to be in the rapid parts of the river; I have not seen it in the tributary creeks, though I have examined them carefully. Several specimens procured.

A second species of this genus exists in the upper waters of the Holston River, (Va.,) which is more elongate than the *P. teretulus*, has smaller scales, and a more vertical range of vision. The thick projectile lips are slightly tuberculous; the orifice of the mouth very small, and the inner edge of the narrow mandible a cartilaginous ridge. Its habit is to lie on the bottom in the main channels of the river, as the form of its mouth would indicate, while the digestive system indicates carnivorous diet. The species does not occur commonly in the smaller creeks. It may be characterized as follows, under the name:

Phenacobius uranops.

Isthmus very wide; teeth 4—4. Head subcylindric; muzzle broad, projecting; orbits oval, having some vertical range, 3.5 times in length head, equal frontal width. Head 4.75 in length to origin caudal, 5.66 to end of same. Depth of dorsal in same respectively 6.25 and 7.25 times. Lateral line straight; scales $\frac{1}{10}$, those on the line of and anterior to the ventrals minute; lower surface from ventrals forward, naked. Pectorals extending $\frac{2}{3}$ way to ventrals. R. 15; ventrals to vent, R. 8; anal narrow, short, 7. Caudal deeply emarginate, its peduncle narrowed; R. 20; dorsal much larger than anal; I. 8; anterior margin longer than depth of body: equal pectorals.

| | |
|----------------------------------|----------|
| Total length | in. lin. |
| Depth at occiput..... | 3 7.5 |
| “ “ dorsal..... | 4.5 |
| “ “ dorsal..... | 6. |
| “ “ caudal peduncle (least)..... | 2.75 |

[August,

Coloration above light olive, with a metallic dorsal line visible only in life; below white. A lateral silver band well defined above only, where it is tinged with leaden. The latter becomes darker on the caudal peduncle. Muzzle and streak through eye and operculum, blackish. Lips yellowish.

From Holston River, near Saltville Va.

September 3d.

The President, DR. HAYS, in the Chair.

Twenty members present.

September 10th.

The President, DR. HAYS, in the Chair.

Twenty-five members present.

The following was presented for publication :

"Description of a new species of Owl of the Genus *Scops*." By D. G. Elliot.

Dr. Leidy exhibited the fossil skull of a Gopher (*Geomys bursarius*), from the loess or yellow marl deposits along the Missouri. The specimen was sent for examination by Dr. Hayden, from Plattsmouth, Nebraska. The skull is partly embedded in a hard argillaceous substance and appears completely petrified. According to Dr. Hayden, in the same formation, teeth of Mastodon and Elephant were found.

Dr. Bridges on behalf of the publication committee, announced that Vol. 6, Part 2 of the Journal was ready for distribution.

September 17th.

MR. CASSIN, Vice-President, in the Chair.

Thirteen members present.

The following was presented for publication :

"A study of the Rhamphastidæ or Toucans." By John Cassin.

Dr. Leidy submitted, for examination, an antique hammer of native copper, found in the Bohemian mine, Michigan, loaned for the purpose by Mr. W. H. Boyer through Mr. W. L. Mactier. It is of rude construction, apparently not cast, but partially cut and partially beaten into shape, which is that of an oblong square with irregularly pitted surfaces. It is about $3\frac{1}{2}$ in. long, $1\frac{1}{2}$ broad, and $1\frac{1}{2}$ wide, and weighs 1 lb. 14 oz. It has an irregular square hole through the centre of the lesser thickness, about large enough to insert the end of the thumb. The sides of the hole are very irregular. The square ends of the hammer are nearly level, though slightly rounded from use.

Dr. Leidy also exhibited a skull of the *Castoroides Ohioensis*, which had been recently sent him for examination by Prof. A. H. Worthen, State Geologist, of Springfield, Illinois. The specimen was found in ploughing, near Charleston, Coles county, Illinois. It is nearly perfect, with the exception of the loss of the zygomata and incisor teeth, and is remarkably well preserved, considering the position in which it was found. The worn condition of the teeth apparently indicates an older individual than the skull from northern New York, described by Prof. Wyman, though the suture between the basi-occipital and

1867.]

basi-sphenoid yet remains open, while it appears to be closed in the New York skull. The specimen is about the same size as the latter, its length being $10\frac{1}{2}$ inches. In addition to the two localities indicated, the remains of this most gigantic of all rodents, recent and extinct, have been found in New York, Ohio, South Carolina, Tennessee, Mississippi and Louisiana.

September 24th.

MR. CASSIN, Vice-President, in the Chair.

Sixteen members present.

Chas. H. Thomas, M. D., and A. G. Hincle, M. D., were elected members, and Rev. Alphonso Wood, Brooklyn, N. Y., was elected a correspondent.

On favorable report of the respective committees, the following were ordered to be published:

Additional Note on Dioicous forms of VITIS VINIFERA, L.

BY THOMAS MEEHAN.

On page 42 of the Proceedings of the Academy, I offered a few observations tending to show that the idea of De Candolle (since adopted by others), that Dioicousism was a peculiar attribute of the American species of *Vitis* and Hermaphroditism of the European was an error, and one which, as it had been adopted as a fact to divide the genus, ought to be corrected; and further, I suggested that the seedless grapes of Europe (currants) were probably pistillate forms. This has produced two letters from Dr. George Engelmann, of so much interest that, with his knowledge, I make the following extracts:

"It is a well known fact that *Vitis vinifera*, when running wild, as it occurs in different localities on the banks of the Rhine, becomes polygamous; and I have specimens of male plants in my herbarium. The berries are small, acerb, and dark bluish-black.

The same, I have learnt from Prof. Parlatore, of Florence, grows in the swampy region near Leghorn, and is as large a plant there as our largest *V. cordifolia* (or *viparia*),—a hundred feet high, and (stem) six or eight inches in diameter.—and is there yet called "Labrusca" by the natives,—the ancient name used also by Virgil and Pliny, showing the same plant to be wild (native or naturalized?) at their time. This is also said by Prof. Parlatore to be dioicous, or rather polygamous.

The number of seeds does not depend on the fertility of the plant, but on the size of the berry; thus our small berries, *V. cordifolia* (*viparia*), bear usually one or two seeds, rarely (if ever) more.

The question with me is whether the plant is ever properly dioicous? I have never found female plants. All that I could examine were either male or hermaphrodite, though the hermaphrodite may not be absolutely perfect,—that is, though the pollen is perfect, it may require the pollen of another (male or hermaphrodite) plant to fertilize it.

Has any one seen purely female plants?

Your hypothesis of the seedless currants I cannot share. If not impregnated, the fruit will come to nothing; but there are seedless varieties of different plants you know."

In another letter, in reply to some suggestions of mine, Dr. Engelmann adds: "I was too hasty in saying that a non-fertilized fruit would not ripen. Those with a fleshy calyx (epigynous) often do, without producing seeds; but of grapes I would doubt it. And, moreover, I do not know—and would like botanists to look to it—whether female flowers are found in *Vitis*! I find only complete, or male plants,—have never seen a purely female. If no one has, will they look out next season?"

[Sept.

These extracts confirm my views in reference to the existence of imperfect forms of *Vitis vinifera*, and they open up an interesting inquiry as to the cause of seedless raisins. One of our fellow members suggests that my hypothesis that they are pistillate forms, imperfectly developed through lack of fertilization, is unlikely, because, with so many vineyards of perfect grapes, at times some of these would get fertilized from stray pollen, and thus we should occasionally find seeds in dried corinths, which we do not. But old writers on the corinth say that berries with seeds are found at times amongst the others, in which case they are double the size (see Prince's *Treatise on the Vine*, pages 97, 98, copied probably from Duhamel). They are perhaps rejected when the currants are being prepared.

However, the object of my note was to refer to the *fact* of the existence of male plants; and the hypothesis in reference to the seedless grapes was introduced rather to stimulate inquiry as to what the facts really are in relation to their real nature and organization.

Description of an apparently new species of OWL, of the Genus SCOPS.

BY D. G. ELLIOT, F. L. S., F. Z. S., ETC.

SCOPS KENNICOTTII.

Head and upper parts light rufous-brown, each feather having a central streak of brownish-black, and also barred with the same color. The rufous-brown hue lightest on the lower part of the neck, where it is almost a buff. The outer feathers of the interscapulars have the outer webs light buff, forming a distinct bar. Wings same color as the back, but the central streak broader. Primaries dark brown, outer webs marked with distinct spots of light buff, slightly discernible on the inner. Secondaries blackish-brown, outer webs distinctly spotted with dark buff. Tertiaries mottled with light buff and black. Ear tufts light buff, with a central streak of black, and barred with the same; broadest on the outer webs. Feathers around the eye reddish-brown; those covering the nostrils soiled white, with black shafts. Concealed patches of white feathers equidistant between the ear-tufts and the ears. Upper part of breast light buff; several feathers on each side having very broad central streaks of black, forming together a conspicuous spot; the rest have this mark much narrower, and the black bars either nearly obsolete, or mere wavy lines. Feathers of the flanks light buff, with a broad line of black in the middle, and a conspicuous bar of pale yellowish-white near their tips. Centre of abdomen and under tail coverts yellowish-white, a few indistinct brown bars on the latter. Feathers of tarsi reddish-brown; of feet yellowish-white. Bill black, white at tip. Claws chestnut at base, rest black.

Total length 11 inches; wing $7\frac{1}{4}$ in., tail 4 in., bill $\frac{1}{2}$ in. along the curve, claws $\frac{1}{2}$ in.

Hab.—Sitka.

The general hue of this curious little owl is a reddish-brown, mottled and blotched with black. In size it is between the *Scops Asio* and *Otus Wilsonianus*, and is not unlike what a cross between these species might be supposed to resemble. It, however, bears very distinctive characters, which free it from any such suspicion, among which, and not the least, is the curious concealed tuft of white feathers just above the ears.

The specimen was procured at Sitka by the expedition engaged in laying the telegraph which is to connect the two great continents of America and Asia, and is one of the most interesting additions which the indefatigable naturalists attached to this band of zealous workers have made to the Avi fauna of North America.

The example from which my description is taken is unique, and belongs to the Academy of Natural Sciences of Chicago, by the kindness of whose officers 1867.]

I am enabled to bring this bird to the notice of ornithologists; and in my large work on the Birds of North America, now publishing, I propose to give a life-size portrait of this species.

In bestowing on this owl the name which I trust it is ever destined to bear, I simply express the desire which I am sure is felt by all ornithologists, to render honor to him who, combining the intrepidity of the explorer with the enthusiasm of the naturalist, twice penetrated the forbidding, cheerless districts of the far north, in order to extend the knowledge of his favorite science; and who perished in his early manhood, in the full tide of his usefulness, on the banks of the Yukon.

Ornithology has met no greater loss, in these later days, than in the death of Robert Kennicott.

A Study of the *RAMPHASTIDÆ*.

BY JOHN CASSIN.

Having been frequently interested, as well as greatly perplexed with the singularly nearly allied forms in this group, and having recently undertaken to study and label the large collections of the Philadelphia Academy and of the Smithsonian Institution, my memoranda have been readily expanded into this memoir. The collection of the Smithsonian Institution is mainly from Mexico and Central America, and contains numerous specimens of species previously known only as exceedingly rare and valuable. The collection of the Philadelphia Academy is quite extensive, and comprehensive also, containing about five-sixths of all known species, nearly the whole of which were presented by its most munificent and judicious patrons, Dr. Thomas B. Wilson, and Edward Wilson, Esq.

In this group, species do certainly exist which are very nearly related to each other, but I am not without a suspicion that the number has been unnecessarily increased, and that several so-called species should be regarded as varieties only, and in a few instances I doubt whether even that distinction is clearly tenable or permanent. In all cases, however, I give the species as I find them described. The splendid Monograph of this group by Mr. Gould renders the study of these birds comparatively easy; and, in very nearly all species, the figures are of the very first class in accuracy and faithfulness of representation.

I. Genus *RAMPHASTOS*, Linnæus.

Genus *Ramphastos*, Linn., Syst. Nat. i. p. 103 (1758).

Ramphastos, Aldrovandus, Orn. i. p. 801 (1599).

Ramphastes, Gesner, Icon. Av. p. 130 (1560).

1. *Ramphastos*.

1. *RAMPHASTOS TOCO*, Müller.

Ramphastos Toco, Müll., Syst. Nat. Supp. p. 80 (1776).

Ramphastos Toco, Gm., Syst. Nat. i. p. 356 (1788).

Ramphastos magnirostris, Swains., Cab. Cy. ii. p. 299 (1837).

Ramphastos nivæus, Less., Supp. Oeuv. Buff.

Ramphastos picatus, Linn., Syst. Nat. i. p. 103 (1758)?

LeVaill. Ois. Par. pl. 2. Buff. Pl. Enl. 82. Gould, Mon. Ramph. 1st ed. pl. 6, 2d ed. pl. 1.

This large and well known species is regarded as the type of the genus *Ramphastos* by all modern authors, but as a matter of after as well as antecedent consideration, and especially for strict constructionists (of which I am one), it is worth remembering that, although the genus was established by Linnæus (or his editor Jussieu) as early as the fourth edition of Syst. Nat., in 1744, this

[Sept.

species seems to have been then quite unknown to him. In the tenth edition (1758), the first species mentioned is *R. piperivorus*, which is now included in the genus *Pteroglossus*; and in the twelfth edition (1766), the first species mentioned is *R. viridis*, also a *Pteroglossus*. This bird does not appear to have ever come under his notice, unless it is *R. picatus* of the tenth edition. The fourth edition of Syst. Nat., in which this name first occurs, was published in Paris, and edited by B. Jussieu (in 1744). The next edition by Linnæus himself is the sixth, in 1748, and this name is given with the orthography as at present,—*Ramphastos* (6th edition Syst. Nat., p. 19, 1748), and as given by Aldrovandus in 1599.

This bird is, however, properly enough regarded as the type of its genus, the name having been first applied to it, and it having been probably the very first species known to naturalists. The bill is described and figured by Belon in 1555. It is more fully described and figured by Conrad Gesner in 1560 (*Icones Avium Omnium*, p. 130), and the present generic name first occurs on the same page: "*Burhynchus* aut *Ramphastes* appellari poterit." Aldrovandus puts it into its present shape: *Ramphastos*, Aldr. Orn. i. p. 801 (1599), and figures quite intelligibly this same species (p. 802), perhaps copying from Gesner, but much enlarging the figure. It was evidently amongst the earliest birds sent to Europe after the discovery of America, and was known by the name of *Ramphastos* at least a century and a half before the time of Linnæus, and is in all characters a typical and representative species of its genus.

Large, bill very large; rich orange, with a large oval spot of black at the tip of the upper mandible, and a transverse band of black at the bases of both mandibles. Throat white, tinged with pale yellow, and in its lower part this white space is generally, but not always edged and tinged with red. (In the next species, *R. albogularis*, the white of the throat is pure, and not tinged with yellow nor edged with red.) This red color frequently wanting in the female, and occasionally in the male, but the yellow tinge is very nearly always present.

Upper tail coverts white, under tail coverts scarlet. All other parts of the plumage black, frequently tinged with brown on the head. Legs greenish or bluish-black.

Total length about 22 to 24 inches; wing 10, tail $6\frac{1}{2}$ to 7, bill (chord from angle of mouth to point of upper mandible) $6\frac{1}{2}$ to $8\frac{1}{4}$ inches. Female rather smaller; total length about 20 inches.

Hab.—Northern and central South America, Guiana, Para, Rio Orinoco, Bolivia (Mr. W. Evans), Paraguay (Capt. T. J. Page), Rio La Plata (Dr. W. S. W. Ruschenberger, U. S. N.), "Chiquitos, Bolivia" (label on D'Orbigny's specimen in Mus. Acad.) Spec. in Mus. Acad. Philada. and Mus. Smiths. Washington.

This fine species seems to have a wide range of locality in South America, undoubted specimens being in the Acad. Mus. from Para, in north-eastern Brazil, and from the Rio La Plata. It is also in the Mus. Smiths., in a very interesting collection from Bolivia presented by Mr. W. Evans, and in the collection made during the exploration and survey of the Rio La Plata and Rio Parana, by Capt. T. J. Page, late of the U. S. Navy. Specimens from the Rio La Plata in the Acad. Mus. were collected and presented by its distinguished and ever faithful member, Dr. W. S. W. Ruschenberger, of the U. S. Navy, and the locality is undoubtedly authentic.

The larger size, especially of the bill, yellow tinge of the white space on the throat and red edgings in the lower part of the same white space, distinguish this species from the next succeeding,—*R. albogularis*. The yellow tinge is present in all specimens that I have seen, though frequently very slight; but in some females the red edgings are wanting entirely.

This species is very probably *Ramphastos picatus*, Linn., Syst. Nat., 10th edition (1758), but he cites as a synonyme Albin, Av. ii. pl. 25, which is apparently a fictitious species, like a *Pteroglossus*. The description applies to the present bird.

2. RAMPHASTOS ALBOGULARIS, Cabanis.

Ramphastos albogularis, Cab., Jour. Orn. 1862, p. 334.

Very similar to the preceding, *R. Tbo.*, but smaller, and with the white space on the throat and neck in front pure, and without yellow tinge or red edgings in its lower part.

1867.]

Transverse band of black at the base of the bill narrow, and spot of black at the tip of upper mandible much smaller. Colors of plumage as in *R. Toco*.

Total length about 19 to 20 inches; wing $8\frac{3}{4}$, tail 6, bill (chord) 5 inches.

Hab.—Southern Brazil (Cabanis). Spec. in Mus. Acad. Philada.

The throat is pure white in this species, if such it is, and the transverse band at the base of the bill seems to be much narrower than in *R. Toco*. The general size is smaller, and the bill much shorter. Probably only to be distinguished from the female of *R. Toco* by the presence or absence of the yellow tinge of the white of the throat, always present in *R. Toco*, always absent in *R. albogularis*. The red edgings and tinge of the white throat are not reliable as a character, being frequently absent in *R. Toco*, but ought to be always so, according to Dr. Cabanis' description, in *R. albogularis*. I suspect that this bird is the young female of *R. Toco*, so far as I can judge from one specimen only in the Acad. Mus., without label, stating locality.

2. *Burhynchus*.

3. *RAMPHASTOS CARINATUS*, Swainson.

Ramphastos carinatus, Swains. Zool. Ill. i. p. (1821).

Ramphastos Tucanus, Shaw, Gen. Zool. viii. p. 362 (1811, nec Linn.)

Ramphastos sulfuratus, Less., Tr. Orn. i. p. 173 (1831).

Ramphastos callorhynchus, Wagl., Syst. Av. (1827).

Ramphastos pœcilorhynchus, Licht.

Ramphastos piscivorus, Linn., Syst. Nat. i. p. 151 (1766) ?

Edwards, Birds, vii. pl. 329. Swains. Zool. Ill. i. pl. 45. Gould, Mon.

Ramph. 1st ed. pl. 7, 2d ed. pl. 2. Edwards, Birds, ii. pl. 64 ?

This large and very handsome species is well known as a bird of Mexico, and in the United States specimens were first introduced in sufficient numbers to supply all museums by Mr. Rafael Montes D'Oca, who obtained them at Jalapa. It stood isolated, and especially characterized by the colors of the bill, until a near relative, *R. brevicarinatus*, was described by Mr. Gould in 1854, and in 1862 another near relative, *R. approximans*, was described by Dr. Cabanis. These species, or supposed species, are very nearly related to each other, and although I have before me no less than thirty-two specimens, certainly representing all three of them, from the Academy and Smithsonian collections, I acknowledge myself quite perplexed in attempting to distinguish satisfactorily between them. At present, I can regard *R. carinatus* and *R. approximans* as differing only in the width of the scarlet band on the lower edge of the yellow space on the throat, and *R. approximans* and *R. brevicarinatus* as differing only in size. There are, however, specimens before me which I cannot clearly refer to either of the three species, though very probably one or the other, and I find it quite impossible to ascertain different geographical districts of locality. In fact, so far as can be determined from specimens before me, evidently very carefully labelled, these species inhabit very nearly the same countries and districts.

Throat yellow. Lower edge of the yellow space of the throat with a very narrow and frequently obscure band of scarlet separating it from the black of the under parts of the body. Bill green, tipped with red, and a large obovate spot of orange near the base of the upper mandible, and an orange line on the culmen. At base of bill a narrow transverse band of black.

Upper tail coverts white, under tail coverts scarlet. All other parts of the plumage black, with a strong tinge of reddish-brown on the top of the head and neck behind. Legs bluish-black.

Total length about 22 to 24 inches; wing $8\frac{1}{2}$, tail 7, bill (chord) $5\frac{1}{4}$ to 6 inches.

Hab.—Mexico, Jalapa (Mr. D'Oca), Mirador, Vera Cruz (Dr. C. Sartorius), Potrero, Cordova (Prof. F. Sumichrast), Vera Paz (Mr. O. Salvin), Coban, Guatemala (Mr. H. Hague), Belize, Honduras (Mr. C. J. Wood). Spec. in Mus. Acad. Philada. and Mus. Smiths. Washington.

The band of scarlet on the lower edge of the yellow space of the throat is very narrow in this species, and frequently not to be seen without examination, but in fourteen specimens now under examination, it is present, and can be

[Sept.

traced in all of them. Specimens of this fine species are in the Smiths. Mus. from Mexico and Central America, as above given, and in Acad. Mus. from Mexico.

4. *RAMPHASTOS APPROXIMANS*, Cabanis.

Ramphastos approximans, Cab., Jour. Orn. 1862, p. 333.

Like the preceding, but with the scarlet band on the lower edge of the yellow space of the throat *conspicuous and much wider*. About the size of the preceding, bill large. Colors of bill and of plumage as in the preceding, *R. carinatus*. "Iris yellow" (Mr. J. Carmiol).

Total length about 21 to 24 inches. Female smaller; total length about 20 inches.

Hab.—Costa Rica, Dota, Grecia, Angostura, San Carlos (Mr. J. Carmiol), San Jose (Dr. A. von Frantzius), Nicaragua, San Juan (Mr. De Bareuil), New Grenada, Panama (Mr. J. McLeannan). Spec. in Mus. Smiths. Washington, and Mus. Acad. Philada.

About the size of the preceding, and with the bill fully as large. Only to be distinguished from that species,—*R. carinatus*,—by the wide and conspicuous scarlet band as above described. Thirteen specimens in the Smithsonian collections from Costa Rica, and one specimen from Panama, are clearly this species. Others in Acad. Mus., from San Juan de Nicaragua, are also certainly this species, and just as certainly correct in locality.

Only differing in size from the next succeeding, *R. brevicarinatus*, both having the wide pectoral band of scarlet. It is possible that the yellow of the throat in *R. brevicarinatus* is darker, or with a tinge of orange, but at present I could distinguish between the female of one and the male of the other, with difficulty, if at all!

5. *RAMPHASTOS BREVICARINATUS*, Gould.

Ramphastos brevicarinatus, Gould, Monog. Ramph. p. (2d ed. 1854).

Gould, Mon. Ramph. 2d ed. pl. 3.

Much resembling the immediately preceding *R. approximans*, and with the scarlet pectoral band wide and conspicuous, but much smaller, and with the bill shorter. Colors of bill and of plumage as in the two preceding, *R. carinatus* and *R. approximans* (but probably with the yellow of the throat of a darker shade than in either).

Total length about 16 to 17 inches; wing $7\frac{1}{2}$, tail $6\frac{1}{2}$, bill (chord) 4 inches.

Hab.—Costa Rica, Chiriqui (Dr. John Evans), "western side of Isthmus of Panama" (Mr. John Gould), "Mexique" (Massena Coll.) Spec. in Mus. Acad. Philadelphia.

In one very fine adult specimen of this species the yellow of the throat is of a darker and richer shade, than in any specimen of either of the two preceding species. This specimen came in a very interesting collection presented to the Academy by Dr. John Evans, and collected by him at Chiriqui, Eastern Costa Rica, thereby confusing somewhat the idea of this species being of the western coast, exclusively. The type of Mr. Gould is also in Acad. Mus. but bears no label stating locality.

6. *RAMPHASTOS TOCARD*, Vieillot.

Ramphastos Tocard, Vieill. Nouv. Dict. xxxiv. p. 281, (1819).

Ramphastos enguathos, Wagl. Syst. Av. Add. (1827).

Ramphastos Swainsonii, Gould, Proc. Zool. Soc. London, 1853, p. 69.

Gould, Mon. Ramph. 2d ed. pl. 4, 1st ed. pl. 8, upper fig. LeVaill, Ois. Par. pl. 9?

Colors of the upper mandible divided by a diagonal line from near the nostril to the edge, within the terminal one-third of its length. Upper portion yellow, lower portion dark reddish-chestnut, lower mandible dark reddish-chestnut, terminal one-third, black. Throat yellow, with a transverse band of white and another of scarlet on its lower edge.

Upper tail coverts white, lower tail coverts scarlet. All other parts of the plumage black; top of the head and neck behind tinged with reddish-brown or *maron*. Legs bluish-brown. Young. Upper mandible entirely greenish-yellow, mottled with black at base. Plumage as in adult.

Total length about 22 to 24 inches; wing 9 $\frac{1}{2}$, tail 6 $\frac{1}{2}$ to 7, bill (chord) 6 $\frac{1}{2}$ inches.

Hab.—Costa Rica, Angostura, San Carlos, Turrialba (Mr. J. Carmiol), New Grenada, Rio Nereua (Capt. N. Michler), "Columbie" (Mr. J. Verreaux). Spec. in Mus. Acad. Philada. and Mus. Smith. Washington.

This is the first of three species in which the colors of the upper mandible are separated by an oblong or diagonal line from near the nostril to the edge within its terminal one-third. In this species the bill is large and tumid
1867.]

and the upper mandible dark red or reddish chestnut on its lower portion, (in *R. ambiguus* and *R. abbreviatus* this lower portion is black). Abundance of specimens in Smiths. Mus. from localities in Costa Rica, and also from Western New Granada in Capt. Michlers Atrato collection. In Acad. Mus. this species is labelled New Granada and "Columbie."

7. *RAMPHASTOS AMBIGUUS*, Swainson.

Ramphastos ambiguus, Swains. Zool. Ill. iii. p. (1823).

Gould, Mon. Ramph. 2d ed. pl. 5, 1st ed. pl. 8, lower fig. Swains. Zool. Ill. iii. pl. 168.

Resembling the preceding, *R. Tocard*, and with the colors of the upper mandible divided in the same manner, but with the lower portion of the upper mandible and the lower mandible black. Colors of plumage as in that species,—*R. Tocard*,—but size rather smaller.

Total length about 20 to 22 inches.

Hab.—Northern and western South America, Bogota, Peru (Mr. Gould.) Spec. in Mus. Acad. Philada. and Smiths. Mus. Washington.

Perhaps rather smaller than the preceding, *R. Tocard*, but much resembling it, and the two species have been constantly confounded. The present bird can always be identified by its black and yellow upper mandible (brick red or reddish chestnut and yellow in *R. Tocard*). Specimens in Acad. Mus. are from Bogota and there are very fine specimens also from Bogota in the magnificent collection presented to the Smithsonian Institution by the Hon. A. A. Burton, late Minister of the United States to New Granada.

8. *RAMPHASTOS ABBREVIATUS*, Cabanis.

Ramphastos abbreviatus, Cab. Jour. Orn. 1862, p. 334.

Resembling *R. ambiguus*, but smaller, and with the red tinge (or "wash") on the head and neck behind, and on the black of the breast, much more distinct. Bill with the colors divided as in the two preceding species, upper portion of upper mandible yellow, lower portion and lower mandible black (as in *R. ambiguus*). Wide pectoral band of scarlet. Colors of plumage as in *R. Tocard* and *R. ambiguus*.

Total length about 18 inches; wing 8½, tail 6, bill 4½ inches.

Hab.—Venezuela, Caracas (Mus. Acad.), Porto Cabello (Dr. Cabanis). Spec. in Mus. Acad. Philada.

Our specimen in the Massena collections now in Mus. Acad. is undoubtedly this species, which, in my opinion, is entirely respectable. It is allied to the two preceding species, but is smaller and has the bill especially smaller and not so wide, in the lateral view. The red tinge on the head and breast is much stronger in this specimen, as stated by Dr. Cabanis in his description of this species as above cited.

3. *Tucanus*.

9. *RAMPHASTOS TUCANUS*, Linnaeus.

Ramphastos Tucanus, Linn. Syst. nat. i. p. 103, (1758).

Ramphastos monilis, Müll. Syst. Nat. Supp. p. 83, (1776).

Ramphastos erythrorhynchus, Gm. Syst. Nat. i. p. 355, (1788).

Ramphastos Le Vaillantii, Wagl. Syst. Av. (1827)?

Ramphastos subfuscatus, Less.

Ramphastos citreopygus, Gould, Mon. Ramph. 1st ed. pl. 2?

Edward's Birds v. pl. 238. Buff. Pl. Enl. 262. Le Vaill. Ois. Par. pl. 3. Gould, Mon. Ramph. 1st ed. pl. 3, 2d ed. pl. 6. Shaw, Nat. Misc. vi. pl. 183. Le Vaill. Ois. Par. pl. 4? Gould, Mon. Ramph. 1st ed. pl. 2?

Throat white, faintly tinged with yellow. Bill crimson, culmen and wide transverse band at base yellow. Upper tail coverts yellow, under tail coverts scarlet, a wide pectoral band of scarlet. All other parts of plumage black. Legs bluish-brown.

Total length about 22 inches; wing 9 to 10, tail 6 to 6½, bill (chord) 6¼ to 7 inches.

Hab.—Northern South America, Guiana, Surinam, Northern Brazil. Spec. in Mus. Acad. Philada. and Mus. Smiths. Washington.

This species is undoubtedly the *R. Tucanus* of Linnaeus, as suggested by that great and philosophical naturalist, Mr. Vigors, in Zool. Jour. ii. p. 471. It is an entirely peculiar and in some respects isolated species, strongly characterized by its red bill. Le Vaillant's figure above cited, Ois. Par. pl. 4, is

[Sept.

very probably, this bird, though the pectoral band is given as yellow instead of scarlet. On this figure *R. Le Vaillantii* is founded as above.

In his first edition Monog. Ramph. Mr. Gould describes and figures a bird to which he gives the name *R. citreopygus*, as above. In his second edition, he states that the specimen figured "is made up of the head of *R. vitellinus* and body of *R. erythrorhynchus*."

10. *RAMPHASTOS INCA*, Gould.

Ramphastos Inca, Gould, Proc. Zool. Soc. London, 1846, p. 68.

Gould Mon. Ramph. 2d ed. pl. 7.

Resembling the preceding, but with the bill black, culmen yellow, and a large somewhat triangular spot of red on each side of the culmen near the base of the bill. A wide transverse band at the base of the bill yellow, with a narrow band of scarlet at its anterior edge. Upper tail coverts rich orange, under tail coverts scarlet, all other parts of plumage black.

Total length about 20 inches.

Hab.—Western South America, Bolivia (Mr. Gould.)

This species is unknown to me, though one specimen in Acad. Mus. seems to approach it, but the upper tail coverts are not so richly colored as in Mr. Gould's figure, though more decidedly orange than in *R. Tucanus*, and the bill being dry and faded long since, does not show the peculiar markings of the present bird. The specimen is rather shorter, and the tail especially so, and the bill larger than in the specimens of that species now under examination. The specimen alluded to is No. 650, and is labelled only "Bresil."

11. *RAMPHASTOS CUVIERI*, Wagler.

Ramphastos Cuvieri, Wagl. Syst. Av. p. (1827).

Ramphastos Forsterorum, Wagl. Syst. Av. p. (1827) ?

Gould Mon. Ramph. 1st ed. pl. 2, 2d ed. pl. 8. Le Vaill. Ois. Par. pl. 5 ?

Bill black. Resembling both of the preceding in colors of plumage, especially *R. Tucanus*, but with the bill black, culmen and wide transverse band at base of bill yellow. Upper tail coverts orange, under tail coverts scarlet, throat white, faintly tinged with yellow, a wide pectoral band of scarlet; all other parts of the plumage black.

Total length about 22 to 23 inches; wing $9\frac{1}{2}$, tail $6\frac{1}{2}$, bill (chord) $6\frac{1}{2}$ to 7 inches.

Hab.—Northern South America, Rio Amazonas. Spec. in Mus. Acad. Philada. and Mus. Smiths. Washington.

Distinguished from *R. Tucanus* by its black bill and orange upper tail coverts and seems to be rather larger. From *R. Inca* this species differs in not having the large spots in the upper mandible nor the scarlet transverse line at the base of the bill. Specimens in Acad. Mus. labelled "Upper Amazon" and other very fine specimens in the Smiths. Mus. from Lieut. Hernon's collections on that river.

The figure in Le Vaill. Ois. Par. pl. 5, may be intended to represent this species, but the throat is orange and the upper tail coverts scarlet. Stated to be from Peru. *R. Forsterorum*, Wagler as above, is founded on this figure.

12. *RAMPHASTOS CULMINATUS*, Gould.

Ramphastos culminatus, Gould, Proc. Zool. Soc. London, 1833, p. 70.

Gould, Mon. Ramph. 1st ed. pl. i. 2d ed. pl. xi.

Bill black. Resembling *R. Cuvieri*, but smaller, with the bill more compressed, and with the throat pure white. Bill black, with the culmen and wide transverse band at base greenish-yellow. Upper tail coverts orange, under tail coverts scarlet, pectoral band narrower and darker red than in *R. Cuvieri*. All other parts of plumage black. Legs bluish-black.

Total length 19 to 20 inches; wing 8 to $8\frac{1}{2}$, tail $6\frac{1}{2}$ to 7, bill 5 to $5\frac{1}{2}$ inches.

Hab.—Western South America, Peru? (Hon. J. R. Clay), Upper Amazon (Mr. Gould). Spec. in Mus. Acad. Philada.

Very much like *R. Cuvieri* but got up on a smaller scale and clearly distinct. The pure white throat is a peculiar and immediately available character, and the pectoral band is narrow and dark red, quite distinct in shade from that of *R. Cuvieri*. It is an entirely respectable species.

The only specimens of this species that I have seen, are in the fine collection made by the Hon. John Randolph Clay, while minister of the United States to Peru, and are very probably from that country.

1867.]

13. *RAMPHASTOS CITREOLAEMUS*, Gould.

Ramphastos citreolaemus, Gould, Proc. Zool. Soc. London, 1843, p. 147.
Gould, Mon. Ramph. 2d ed. pl. 9. Gray, Gen. B. ii. pl. 100.

Like the preceding and *R. Cuvieri*, but smaller, and with the pale yellow space on the throat nearly encircled with white. Bill black, with the culmen and wide transverse band at base yellowish-green. The yellow on the neck in front clearer defined, and of a darker shade than in either of its preceding allies. Upper tail coverts pale yellow.

A wide pectoral band of scarlet, under tail coverts scarlet, all other parts of the plumage black. Scarlet of the under tail coverts extending upwards, and appearing somewhat in the upper tail coverts (which are yellow). Legs bluish-black.

Total length about 21 inches; wing $8\frac{1}{4}$, tail $7\frac{1}{2}$, bill $5\frac{1}{4}$ inches.

Hab.—Northern South America, Bogota. Spec. in Mus. Acad. Philada.

Smaller than *R. Cuvieri*, but about the size of *R. culminatus*. Differs from the former in having the white space on the throat strongly tinged with yellow in its lower part only, and in having the upper tail coverts pale yellow, (in both *R. Cuvieri* and *R. culminatus* the upper tail coverts are orange). In *R. culminatus* the throat is pure white and scarlet, pectoral band narrow; in this species, *R. citreolaemus*, the white space is strongly tinged with yellow in its lower part and the pectoral band, wide, and of a different shade of scarlet.

The only specimens that I have seen of this species are Mr. Gould's types in the Acad. Mus., both of which were received in the Massena collection, presented to the Academy by Dr. Thomas B. Wilson.

14. *RAMPHASTOS OSCULANS*, Gould.

Ramphastos osculans, Gould, Proc. Zool. Soc. London, 1835, p. 156.

Gould Mon. Ramph. 1st ed. pl. 5, 2d ed. pl. 10.

Very much like the preceding, *R. citreolaemus*, but with the upper tail coverts orange, and the neck in front orange. Bill black, culmen and wide transverse band at base yellowish-green. Plumage of other parts as in *R. citreolaemus*.

Total length about 19 inches.

Hab.—Northern South America, Guiana, Rio Negro (Mr. Gould).

This species I have not seen. Judging from Mr. Gould's description and from his superb figure, it differs from *R. citreolaemus* sufficiently, in the orange of the neck in front, and upper tail coverts as above, (both of which are yellow in *R. citreolaemus*).

4. *Ramphodryas*.15. *RAMPHASTOS ARIEL*, Vigors.

Ramphastos Ariel, Vig., Zool. Jour. ii. p. 466, (1826).

Ramphastos Temminckii, Wagl., Syst. Av. Ramph. No. 10, (1827).

Ramphastos Tucanus, Wagl., Syst. Av. Ramph. No. 11, (1827), nec. Linn.)?

Ramphastos erythrosoma, Wagl., Syst. Av. Ramph. No. 9, (1827)?

Ramphastos maximus, Cuv. Reg. An. i. p. 431, (1817)?

Ramphastos flavicollis, Müll. Syst. Nat. Supp. p. 83, (1776)?

Gould, Mon. Ramph. 1st ed. pl. 10, 2d ed. pl. 12. Buff. Pl. Enl. 307? Le Vaill. Ois. Par. pl. 6? Zool. Jour. ii. pl. 15.

Smaller. Bill black, with a wide transverse band of yellow at base, flattened somewhat, and with a wide groove near the culmen. Upper tail coverts scarlet. Throat orange, with a narrow band of pale yellow on its lower edge, which is succeeded by a wide band of scarlet on the breast. Under tail coverts scarlet. All other parts of the plumage black. Legs bluish-black. Throat in some specimens reddish-orange.

Total length about 18 to 21 inches; wing 7 to 8, tail $6\frac{1}{2}$ to 8, bill (chord) 4 to 5 inches.

Hab.—Northern and eastern South America, Bahia, St. Catherine's, San Paulo. Spec. in Mus. Acad. Philada. and Mus. Smiths. Washington.

This is the first of several species in which the upper tail coverts are scarlet. In this species the bill is uniformly clear black, including the culmen, and having only a transverse band, at base, of yellowish white. So far as can be determined from dried specimens the bill in this species is more flattened than usual in this group and with a wide but shallow groove, leaving the culmen very distinct.

The specimens before me from various localities and all of which I regard

[Sept.

as one species, would make about three, with some stretch of propriety. One specimen from St. Catherines, Brazil, is larger than all others: total length 21 inches, wing $8\frac{1}{2}$, tail $7\frac{1}{2}$ inches, but the bill is shorter than others; length (chord) $4\frac{1}{2}$ inches. Two other specimens labelled only "Bresil," have the throat dark reddish orange, (or orange red) much darker red than usual in specimens from Bahia. The largest seems to be that figured and described by Mr. Gould.

It is not to be concluded hastily that the species proposed by Wagler as above are all to go for nothing. Two of them, *R. Tucanus* and *R. erythrosoma*, seem to be founded on figures, and, if said figures are correct, they are valid species. These figures may represent *R. Ariel* with some exaggerations and oversights. Wagler's species are:

1. *Ramphastos Temminckii*, which is *R. Ariel* as above given.
2. *Ramphastos erythrosoma*, founded on Le Vaill. pl. 6, which is much like *R. Ariel*, but has the under parts almost entirely scarlet.
3. *Ramphastos Tucanus*, (Wagl. nec. Linn.) *R. flavicollis*, Müller, founded on Pl. Enl. 307, in which the upper tail coverts are orange, (not scarlet, as in *R. Ariel*) and the pectoral band narrow (it is very wide in *R. Ariel*.)

The following are varieties in the collections now under examination:

- R. Ariel*, a. Throat pale orange. Eastern Brazil, Bahia.
- b. Throat deep reddish orange, bill longer. Northern, Amazon River.
- c. Large, bill shorter, throat pale orange. Southern, St. Catherines, Rio de Janeiro.

16. RAMPHASTOS VITELLINUS, Temminck.

Ramphastos vitellinus, Temm., Man. D'Orn. i. p. 76, (1820.)

Gould, Mon. Ramph. 1st ed. pl. 9, 2d ed. pl. 13. Le Vaill. Ois. Par. pl. 7. Swains, Zool. Ill. i. pl. 56.

Bill black, upper tail coverts scarlet, large space on the throat orange in the middle and lower part, fading into pure white on its edges, throat, and sides of the neck. Wide pectoral band and under tail coverts scarlet. All other parts of the plumage black, legs bluish-black. Bill black, with a transverse band of pale blue at base, flattened and grooved near the culmen.

Total length about 19 to 20 inches; wing $7\frac{1}{2}$ to 8, tail $6\frac{1}{2}$ to 7, bill $4\frac{1}{2}$ to 5 inches.

Hab.—Northern South America, Guiana, Cayenne, Northern Brazil. Spec. in Mus. Acad. Philada. and Mus. Smiths. Washington.

In all American collections, and not difficult to distinguish from any other species. The bill is entirely black, including the culmen, but having a wide transverse band of pale blue at base.

5. *Tucaius*.

17. RAMPHASTOS DICOLORUS, Linnaeus.

Ramphastos dicolorus, Linn. Syst. Nat. i. p. 152, (1766).

Ramphastos chlororhynchus, Temm. Man. d'Orn. i. p. 76, (1820).

Ramphastos pectoralis, Shaw, Gen. Zool. viii. p. 365, (1811).

Ramphastos Tucui, Licht. Verz. p. 7, (1823).

Buff. Pl. Enl. 269. Le Vaill. Ois. Par pl. 8. Swains. Zool. Ill. ii. pl. 108. Jard. & Selby, Ill. i. pl. 29. Gould Mon. Ramph. 1st ed. pl. xi. 2d ed. xiv.

Bill green, with a transverse band of black at base. Entire under parts of body scarlet, with a transverse band of black on the abdomen; tibiae black. Upper and under tail coverts scarlet. Large space on the throat, orange in the middle and fading into pale yellow on its edges, throat, and sides of the neck. All other parts of the plumage black. Legs brownish-black. Bill flattened and grooved near the culmen.

Total length about 17 to 20 inches; wing $7\frac{1}{2}$ to 8, tail $6\frac{1}{2}$ to 7, bill $3\frac{1}{2}$ to 4 inches.

Hab.—Central and eastern South America, Brazil, St. Catherines, Rio de Janeiro, San Paulo, Paraguay. Spec. in Mus. Acad. Philada. and Mus. Smiths. Washington.

This abundant and handsome species differs from all others of this genus, in having the bill green and the under parts almost entirely scarlet, the tibiae and a narrow belt on the abdomen being black. It is in all American collections.

1867.]

II. Genus PTEROGLOSSUS, Illiger.

Genus Pteroglossus, Ill. Prodr. p. 202 (1811).

1. *Pteroglossus*.

1. PTEROGLOSSUS ARACARI, (Linnæus).

Ramphastos Aracari, Linn. Syst. Nat. i. p. 104, (1758).

Ramphastos atricollis, Müll. Syst. Nat. Supp. p. 83, (1776).

Gould, Monog. Ramph. 1st ed. pl. 12, 2d ed. pl. 15. Buff. Pl. Enl. 166. Shaw, Nat. Misc. pl. 198. Le Vaill. Ois. Par. pl. 10, 12.

Adult ♂. With one wide, well defined band of scarlet on the abdomen. Entire head and neck glossy black; back, wings and tail fine dark green; under parts of body greenish-yellow (except the wide band of scarlet across the abdomen). Tibiæ olive-green, mixed with reddish; rump scarlet. Bill with the upper mandible yellowish-white, (or straw color) and a wide longitudinal band of black on the culmen; under mandible black; at the base of both mandibles, and completely enclosing the bill, a raised band of straw-yellow. Legs greenish. Frequently an obscure spot of dark chestnut on the ear, and usually an obscure and imperfect narrow band of scarlet between the black and yellow on the neck or breast.

Total length about 18 or 19 inches; wing 6, tail $7\frac{1}{2}$, bill (chord) 4 to 5 inches.

Hab.—North-eastern South America, Guiana, Northern Brazil. Spec. in Mus. Acad. Philada. and Mus. Smiths. Washington.

This might erroneously be supposed to be a common and well known species, but between *P. formosus* on one side, which is larger, and *P. Wiedii* on the other, which is smaller, but both otherwise very similar, it is not entirely easy to fix its identity, nor to ascertain which of the three was originally described. At present I rely on the plate and description of Mr. Gould.

The wide band or stripe on the culmen is the only remaining hope for this species, this stripe being narrow (or not so wide!) in both of its aspiring relatives, now about to be brought forward. It does appear, though, that the *tibiæ* are more mixed with red than in either *P. formosus* or *P. Wiedii*, and other small points of difference can be developed by the diligent and patient student.

2. PTEROGLOSSUS WIEDII, Sturm.

Pteroglossus Wiedii, Sturm, ed. Gould's Ramphast. p.

Sturm, ed. Gould's Monog. pl. Gould, Monog. 2d ed. pl. 16.

Much resembling the preceding, but smaller, with the bill shorter and less curved, and the longitudinal stripe on the culmen much narrower. Tibiæ more clearly dark green; breast with little or no mixture of scarlet.

Total length about 17 or 18 inches; wing $5\frac{1}{2}$ to $5\frac{3}{4}$, tail $6\frac{1}{2}$ to 7, bill (chord) 4 to $4\frac{1}{2}$ inches.

Young male. Throat and sides of the neck with a decided tinge of dark chestnut; other parts as in adult.

Hab.—Central and eastern South America, Bahia, Rio de Janeiro. Spec. in Mus. Acad. Philada.

Smaller than the preceding, with the longitudinal stripe on the culmen narrow. Inhabits more southern districts of South America.

3. PTEROGLOSSUS FORMOSUS, Cabanis.

Pteroglossus formosus, Cab. Jour. Orn. 1862, p. 332.

Much resembling both of the preceding, but larger than either. Stripe on the culmen narrow, as in *P. Wiedii*. Yellow plumage of the breast mixed with red, as in *P. Aracari*. Tibiæ green, as in *P. Wiedii*. Bill long, strongly curved at the end (perhaps more slender than in either of the preceding).

Total length about 19 or 20 inches; bill (chord) $5\frac{1}{2}$ inches.

Hab.—Northern South America, "Venezuela" (Cabanis). Spec. in Mus. Acad. Philada.

Young. This species? Bill thick, much shorter than in adult, cutting edge of upper mandible integral, smooth (not serrated as in adult). Entire head dull brown or snuff color, darker on the crown; upper part of back, wings and tail dark green; under parts of body dull and pale greenish-yellow; wide band across the abdomen dull yellowish-red. Bill nearly uniform greenish-yellow, darker on the under mandible, lighter at the tip. Yellow of the breast mixed with pale reddish.

Total length about 14 inches.

This is a large species like *P. Aracari*, but with the longitudinal stripe on the culmen narrow as in *P. Wiedii*. One specimen in the Acad. Mus. is this bird. It is labelled "Demarara" in a hand writing that I do not recognise.

[Sept.

4. *PTEROGLOSSUS PLURICINCTUS*, Gould.

Pteroglossus pluricinctus, Gould Proc. Zool. Soc. London, 1835, p. 157.
Gould, Monogr. Ramph. 1st ed. pl. 15, 2d ed. pl. 17.

About the size of *P. Aracari*, or rather larger. With two bands on the under parts of the body; one is black across the breast, the other is mixed black and scarlet across the abdomen. Head and neck black, with a rich bluish lustre; back, wings and tail dark green; rump scarlet. Under parts of body (except the bands) fine greenish-yellow or straw-color, much mixed with scarlet; lower band almost entirely scarlet and expanded on the sides; tibiae greenish-chestnut.

Upper mandible rich yellow, nearly orange on the basal half of the bill, a wide stripe of brownish-black on the culmen, under mandible brownish-black, bill enclosed at base by a raised line of yellow. Female and young male with the ears fine chestnut.

Total length about 18 to 20 inches; wing 6 to 6½, tail 7, bill (chord, from corner of mouth direct to point) 4 to 4½ inches. "Iris yellow" (Lieut. Herndon, in Smiths. Mus.)

Hab.—Northern South America, "Rio Negro," "Rio Orenoque" (Acad. Mus.), "Petas, Amazon River" (Lieut. Herndon). Spec. in Mus. Acad. Philada. and Mus. Smiths. Washington.

A beautiful and strongly characterized species, easily distinguished from either of the preceding by its two bands on the under parts. It is, however, singularly afflicted with relatives (as follows immediately) and to avoid discouraging entanglements, it is necessary to remember that in this species and the next succeeding only, *P. pœcilosternus*, the upper band (on the breast) is complete and well defined and black. In all others the upper band is imperfect or rudimentary, or not at all.

5. *PTEROGLOSSUS PŒCILOSTERNUS*, Gould.

Pteroglossus pœcilosternus, Gould, Proc. Zool. Soc. London, 1843, p. 147.
Gould, Monogr. Ramph. 2d ed. pl. 18. Le Vaill. Ois. Parad. pl. 11.

Only differing from the preceding in having the lower band (on the abdomen) nearly fine scarlet, or but slightly mixed with black, and the yellow of the under parts less mixed with scarlet.

Total length 18 to 20 inches.

Hab.—Western South America, Peru. Spec. in Mus. Acad. Philada. and Mus. Smiths. Washington.

This species, if such it is, inhabits a more western range of locality than the next preceding, *P. pluricinctus*, which it exceedingly resembles. One specimen in Smiths. Mus. is in Lieut. Herndon's collection from the Western tributaries of the Rio Amazon. One other in the Acad. Mus. bears Mr. Gould's label, but without locality.

6. *PTEROGLOSSUS ERYTHROPYGIUS*, Gould.

Pteroglossus erythropygius, Gould, Proc. Zool. Soc. London, 1843, p. 15.
Voy. Sulphur, Birds pl. 28. Gould, Monogr. Ramph. 2d ed. pl. 21 (lower figure).

Under mandible yellow, tipped with black (the under mandible is black in all others of this connection). Upper mandible with a wide longitudinal band parallel with its cutting edge (which the preceding two species have not). Otherwise much resembling *P. pluricinctus* and *pœcilosternus*.

Total length 18 inches (Gould).

Hab.—Realejo, Western Nicaragua (Mr. Gould).

This species I have not seen. It appears to be much like the various allies of *P. pluricinctus*, but has the under mandible yellow in its basal two thirds. Nearly allied also to the next succeeding (*P. sanguineus*) but that species has the under mandible black.

7. *PTEROGLOSSUS SANGUINEUS*, Gould.

Pteroglossus sanguineus, Gould, Monogr. Ramph. 2d ed. p. (in text of *P. erythropygius*), (1854).

Pteroglossus erythropygius, Cassin, Cat. Michler's collection, Proc. Acad. Philada., 1860, p. 136.

Gould, Monogr. Ramph. 2d ed. pl. 21 (upper figure).

Resembling the immediately preceding, but with the under mandible black (which is yellow in that species—*P. erythropygius*). A longitudinal band of black near the cutting edge of the upper mandible, as in the preceding (but not in any other of the allies of *P.*

1867.]

pluricinctus). Yellow of the under parts much mixed with scarlet. Otherwise much resembling *P. pluricinctus*.

Total length about 18 to 20 inches; wing 6 to 6½, tail 7 inches. Female rather smaller. *Hab.*—New Grenada, Rio Truando, a tributary of the Rio Atrato. Spec. in Mus. Smiths. Washington, and Mus. Acad. Philada.

Six specimens in Capt. Michler's collection, from the Rio Atrato and its tributaries, are undoubtedly this species, and as distinct as customary in this group from *P. erythropygius*. It is probably not smaller than that species.

8. *PTEROGLOSSUS TORQUATUS*, (Gmelin).

Ramphastos torquatus, Gen. Syst. Nat. i. p. 354, (1788).

Pteroglossus ambiguus, Less. Traite. d'Orn. i. p. 178, (1831).

Pteroglossus regalis, Licht.

Ramphastos discolor, Müll. Syst. Nat. Supp. p. 83, (1776).

Tucana mexicana torquata, Briss. Orn. iv. p. 421.

Gould, Monog. Ramph. 1st ed. pl. 14, 2d ed. pl. 20.

Generally resembling the preceding, but rather smaller, and distinguished by a band of chestnut on the neck behind. Upper band (on the breast) nearly obsolete, or represented only by a large black spot on the breast. Yellow of the under parts much mixed with scarlet.

Total length about 17 inches.

Young ♂. Bill with the cutting edges plain, without serratures, and entirely light brown, yellowish on the edges of the upper mandible. Adolescent. Under mandible nearly black; upper mandible orange at base; plumage nearly as in adult, but dull, and abdominal band narrow and imperfect.

Hab.—Central America, Northern South America, Mexico? Spec. in Mus. Acad. Philada. and Mus. Smiths. Washington.

Numerous specimens in Smiths. Mus. from Angostura and Turrialba, Costa Rica, and from Coban and Choctun, Central Guatemala, and in the Acad. Mus. from Chiriqui, Costa Rica, and Veragua, New Grenada, and several specimens labelled "Mexique." One specimen in Acad. Mus. is labelled "Guayaquil," Ecuador.

This handsome Toucan, was until recently, a highly respectable species, eminently distinguished by its chestnut collar worn on the neck behind; but that character is no longer peculiar, two other species having appeared setting up the same badge of distinction with some propriety. We will proceed to examine their claims without unnecessary delay.

9. *PTEROGLOSSUS NUCHALIS*, Cabanis.

Pteroglossus nuchalis, Cabanis, Jour. Orn. 1862, p. 332.

Very similar to the preceding.—*P. torquatus*,—and with a chestnut collar on the neck behind. Bill larger, longer, and curved at the end at a wider or more obtuse angle. Black spot on the breast smaller, and yellow of the under parts more mixed with scarlet than in *P. torquatus*.

Total length about 18 inches.

Hab.—"Porto Cabello" (Cabanis). Spec. in Mus. Acad. Philada.

This species, if so, can be recognized mainly by its larger and longer bill, gradually curved and not so decidedly nor abruptly hooked at the end as in *P. torquatus*. The under parts in the specimen before me are more mixed or spotted with scarlet than in either of ten specimens of that species (*P. torquatus*) in the Acad. and Smiths. collections, and at the termination of the black on the neck in front there is a band of bright scarlet, narrower, but more complete than in either of them. It may be only a full plumaged or older specimen of that species!

The only specimen in Acad. Mus. is labelled "*Pteroglossus regalis*, ♂ ? Mexique," in a handwriting that I do not recognise.

10. *PTEROGLOSSUS FRANTZII*, Cabanis.

Pteroglossus Frantzii, Cab. Sitz. Bericht Naturf. Berlin, 1861. Jour. Orn. 1862, p. 332.

Like *P. torquatus* and *P. nuchalis*, and about the same size or rather larger, but with the abdominal band very wide and nearly pure scarlet. Upper mandible yellow, except the usual stripe on the culmen, which is black, and a space of dark greenish at base (yellow at the tip, which is black in *P. torquatus* and *P. nuchalis*). Chestnut-colored collar on the neck

[Sept.

behind darker, and perhaps more narrow than in those species. Bill larger and wider than in *P. torquatus*, but not so long as in *P. nuchalis*, and with the teeth smaller than in either. In other characters much resembling these and other allies of *P. pluricinctus*.

Total length about 18 to 19 inches; wing 6 to 6½, tail 6½ to 7, bill (chord of upper mandible) 4 inches.

Young. Bill with the cutting edge of upper mandible smooth (not serrated, as in the adult), entirely dull brown. Head dark brown; abdominal band yellowish-scarlet. General colors as in adult.

Hab.—Costa Rica, "San Jose," "Angostura," "Chiriqui." Spec. in Mus. Smiths. Washington, and Mus. Acad. Philada.

This species is of the same general style and colors as the two preceding, and has a well defined nuchal collar, but is easily to be recognized by its wide and clear scarlet abdominal band, and yellow pointed upper mandible. The abdominal band is more than double the width of that of either *P. torquatus* or *P. nuchalis*, and seems to afford a character entirely reliable in determining this species.

Specimens in the Smiths. Mus. are from the large and very interesting collections of Mr. Julian Carmiol, made at various localities in the Republic of Costa Rica as above cited.

11. *PTEROGLOSSUS CASTANOTIS*, Gould.

Pteroglossus castanotis, Gould, Proc. Zool. Soc. London, 1833, p. 119.

Gould, Monogr. Ramph. 1st ed. pl. 13, 2d ed. pl. 19.

This is one of the strongly marked species of this sub-group, and (in a sort of aggregate) is not difficult to recognize, a large space on the sides of the neck, continuing into a wide collar on the neck behind, being rich dark chestnut. In all specimens before me the neck in front is chestnut also, but this space differs in extent, and may give place to black. In two specimens the throat, immediately at the base of the under mandible and within its fork, is black, in others it is chestnut. One band only on the abdomen, which is wide and well defined, and bright scarlet.

Entire justice has not been done to this species, regarding as praiseworthy example the treatment of *P. aracari*, *P. pluricinctus*, and *P. torquatus*. Like them, it heads a group of allies and affinities which seem to inhabit different localities; and in the specimens now before me I think I could set up a species or two, as customs seem to prevail in this group. But having got through the almost inextricable tangle of the preceding ten species, after a fashion, I am quite demoralized, and very sure that no living man can remember the species already described in this group, unless, like the gay young gentleman who tied his cravat with such wonderful success, he gives his whole mind to it.

Adult ♂. Sides of the neck rich dark chestnut, which color continues into a wide, well defined band on the neck behind; frequently, neck in front also chestnut. Head above, and throat black, especially near the commencement of the yellow of the under parts (but above frequently chestnut). Back, wings and tail dark green. Rump scarlet; a wide band on the abdomen scarlet; other under parts pale greenish-yellow, mixed with scarlet on the breast and under tail coverts. Tibiæ dark chestnut, frequently mixed with green. Upper mandible yellow, with a wide band of black on the culmen in its basal three fourths, and another at its base and near its cutting edge, of nearly the same length. Under mandible black. Legs dark colored. ♀. Like the male, but with the chestnut of the head more extended.

Total length about 17 to 22 inches; wing 6 to 7, tail 5½ to 7, bill (chord) 3¾ to 5¼ inches.

Hab.—Northern and western South America, Rio Amazon (Lieut. Herndon), Para (Imp. Mus. Rio de Janeiro), Peru (Mr. Gould).

This fine species is strongly characterized by the chestnut color of the neck, throat and cheeks, but this color seems to be variable in extent, and in some specimens now before me extends to the top of the head. The size of specimens is also quite different, the smallest in the present collection being in Capt. Page's collection from the Rio Parana, and labelled "Brazil,"—undoubtedly correct, and showing the most southern locality yet ascertained for this species. These are both sexes in mature plumage, and so much smaller than specimens from the Rio Amazon that they would easily make a species in this group. Another specimen in the Acad. Mus., labelled ♀, has the head

1867.]

entirely chestnut, with only frontal and superciliary stripes black. Three varieties of this species may be distinguished:

- P. castanotis*, a, *castanotis*.—Larger; head above black; total length about 20 to 22 inches. Northern, Rio Amazon, Peru.
 b, *australis*.—Smaller; head above brownish-black; total length about 16 to 17 inches. Southern, Rio Parana.
 c Entire head chestnut, with a frontal band and superciliary stripes black. Locality unknown. Perhaps young female of var. *castanotis*.

2. *Grammarhynchus*.

Genus *Grammarhynchus*, Gould, Monogr. Ramph. Intr. p. 26 (2d ed., 1854).

12. *PTEROGLOSSUS INSCRIPTIS*, Swainson.

Pteroglossus inscriptis, Swains. Zool. Ill. ii. p. (1820).

Pteroglossus scriptus, Temm. Man. d'Orn, i. p. 76 (1820).

Gould, Monogr. Ramph., 1st ed. pl. 23, 2d ed. pl. 23. Swains. Zool. Ill. ii. pl. 90.

This is the first of three species which form a sub-group of the genus *Pteroglossus*; all having the plumage dark green on the upper parts, and plain greenish-yellow on the under parts, without the bands and spots which are so conspicuous in the preceding sub-group, or typical *Pteroglossus*. These species resemble each other, but differ in size and other characters, especially the colors and markings of the bills, and are without exception represented with entire accuracy in Mr. Gould's Monograph of the Ramphastidae.

Adult ♂. Small; bill with both mandibles yellow, tipped with black, the under mandible black at base, and a wide longitudinal band on the culmen black. Both mandibles with irregular black marks on their cutting edges (rather remotely resembling letters). Head and neck black; back, wings and tail dark green; rump scarlet; under parts of body greenish-yellow or lemon-yellow; tibiae mixed with chestnut; legs dark green.

Adult ♀. Throat and sides of the neck dark chestnut, otherwise like the male.

Young ♂. Bill dull yellow, with the band on the culmen dull brown and indistinct, and tipped with dull brown. Head above black, throat chestnut; otherwise as in adult. Yellow of the under parts with obscure spots of dull reddish.

Total length about 13 inches; wing $4\frac{1}{2}$, tail $5\frac{1}{2}$, bill (chord) $2\frac{3}{4}$ to $3\frac{1}{4}$ inches.

Hab.—Northern south America, Northern Brazil, "Guiana," "Para." Spec. in Mus. Acad. Philada.

Distinguished from the succeeding by the under mandible being yellow in a large middle space (the under mandible is entirely black in both of the succeeding,—*P. Humboldtii* and *P. viridis*). This is a common species in collections, and of which numerous specimens are in Acad. Mus., but none of them very carefully labelled for locality, being only given as "Brazil" and "Guiana."

13. *PTEROGLOSSUS HUMBERTII*, Wagler.

Pteroglossus Humboldtii, Wagl. Syst. Av. p. (1827).

Gould, Monogr. Ramph., 1st ed. pl. 22, 2d ed. pl. 22.

Resembles the preceding. *P. inscriptis*, but is larger, and has the under mandible black. Cutting edge of the upper mandible with irregular black marks, remotely resembling letters. Tibiæ chestnut, and in some specimens there are obscure marks of dull chestnut, forming an imperfect and partially concealed band on the abdomen. Plumage in both sexes as in the preceding.

Total length about 15 to 17 inches; wing 5 to $5\frac{1}{2}$, tail 6 to $6\frac{1}{2}$, bill (chord) $3\frac{1}{2}$ to 4 inches.

Hab.—Northern Brazil, "Upper Amazon," "Minas Geraes," Peru, "Head waters of the Huallaga River." Spec. in Mus. Acad. Philadelphia, and Mus. Smiths. Washington.

Clearly distinguished from the preceding by its black under mandible. Specimens in the extensive and valuable collection made by Mr. Walter S. Church, from the head waters of the Huallaga River, Peru, are the largest, and have a partial band on the abdomen, of chestnut, much more apparent than in specimens from Mr. Wallace's collections on the Upper Amazon. The

[Sept.

bill also seems more slender. Specimens in Acad. Mus. labelled "Upper Amazon."

14. *PTEROGLOSSUS VIRIDIS* (Linnæus).

Ramphastos viridis, Linn. Syst. Nat. i. p. 156 (1766).

Ramphastos glaber, Lath. Ind. Orn. i. p. 138 (1790).

Pteroglossus brevirostris, Less. Traité d'Orn. i. p. 178 (1831).

Gould, Monogr. Ramph. 1st ed. pl. 21, 2d ed. pl. 24. Swains. Zool. Ill. iii. pl. 169. Shaw, Nat. Misc. xvii. p. 717. Buff. Pl. Enl. 727, 728. Le Vaill. Ois. Par. pl. 16, 17. Edwards' Birds, vii. pl. 330.

Like the preceding in colors and general characters, but without the irregular letter-like marks on either mandible. Upper mandible dull greenish-yellow, with a black line near to and parallel with the culmen; under mandible black. Plumage of the male much as in the preceding; head black, back, wings and tail dark green; under parts greenish-yellow; tibiae green, mixed with dull chestnut.

Female. Head and neck chestnut; otherwise like the male.

Total length about 13½ inches; wing 4½ to 4¾, tail 4½ to 5, bill (chord) 3½ inches.

Hab.—Northern South America, "Guiana." Spec. in Mus. Acad. Philada.

Long known and common in collections from Guiana and Northern Brazil. Numerous specimens in Acad. Mus., but labelled only "Guiana" and "Brazil."

3. *Pyrosterna*.

Genus *Pyrosterna*, Bonap. Aten. Ital. (1854.)

15. *PTEROGLOSSUS BITORQUATUS*, Vigors.

Pteroglossus bitorquatus, Vig. Zool. Jour. ii. p. 481 (1826).

Gould, Monogr. Ramph. 1st ed. pl. 16, 2d ed. pl. 26.

We now enter upon another well defined sub group, presenting brilliant colors, and with a wide belt of scarlet on the breast in all of the five species at present known. Very handsome, and distinguished from each other mainly by the colors of the bills.

Adult ♂. Bill with the upper mandible yellow, under mandible white at base, with its terminal half black. Head above black; throat and sides of the neck chestnut; a narrow crescent of pale yellow on the neck in front, succeeded by a wide transverse band of scarlet; abdomen pale yellow; tibiae dull green. Wide space on the neck behind scarlet; back, wings and tail dark green; rump scarlet. Legs greenish-blue. Sexes alike?

Total length about 14 inches; wing 4½ to 5, tail 5½, bill (chord) 3½ to 3¾ inches.

Hab.—Northern South America, "Para," "Guiana." Spec. in Mus. Acad. Philada.

Of this gayly colored species four specimens are in the Acad. Mus., which are all that I have seen. It is easily distinguished by its white and black under mandible, and is accurately and very handsomely figured by Mr. Gould as above. Specimens in Acad. Mus. are labelled "Para" and "Guiana," and occasionally brought also in collections from New Grenada.

16. *PTEROGLOSSUS STURMII*, Natterer.

Pteroglossus Sturmii, Nat. in Imp. Mus. Vienna. Sturm ed. Gould Monog. (not paged, 1842.) Gould, Monog. Ramph. 2d ed. (1854.)

Gould, Monogr. Ramph. 2d ed. pl. 17. Sturm's ed. pl. 7.

Similar to the preceding, but smaller, and with the under mandible entirely black.

Hab.—Northern South America, "Rio Madeira" (Natterer). Spec. in Imp. Mus. Vienna

This species I have not seen. Its point of distinction from *P. bitorquatus* is mainly its black under mandible, but a few other characters are pointed out in Sturm's edition of Gould's Ramphastidæ, as above, and in Mr. Gould's second edition.

17. *PTEROGLOSSUS FLAVIROSTRIS*, Fraser.

Pteroglossus flavirostris, Fras. Proc. Zool. Soc. London, 1840, p. 60.

Pteroglossus Azaræ, Gould, Monog. Ramph., 1st ed. (nec Vieill.)

Gould, Monog. Ramph., 1st ed. pl. 17, 2d ed. pl. 29.

Generally resembling the two preceding, but with the scarlet belt restricted to the neck.

in front, and succeeded by a wide transverse belt of black, edged with scarlet on its lower border; abdomen greenish-yellow. Head above black; throat and sides of the neck chestnut; neck behind with a wide band of brownish-red or deep red (nearly scarlet). Back, wings and tail dark green, rump scarlet. Bill yellow, with a transverse band of orange near the cutting edge of the lower mandible; edge of the upper mandible black.

Total length 12 to 15 inches; wing $4\frac{1}{2}$ to 6 $\frac{1}{2}$, tail 5 to 6 $\frac{1}{2}$, bill (chord) $3\frac{1}{4}$ to 3 $\frac{3}{4}$ inches.

Hab.—Northern South America, New Grenada, Northern Brazil, Rio Negro, Rio Amazonas, Para. Spec. in Mus. Acad. Philada. and Mus. Smiths. Washington.

This very handsome species is frequently received in collections from Bogota, and is readily distinguished from the two preceding by its wide band of black on the breast, the scarlet band being restricted to the neck in front. From the two species next succeeding, *P. Mariæ* and *P. Azaræ*, this bird is mainly distinguished by the colors of the bill.

18. *PTEROGLOSSUS MARIÆ*, Gould.

Beauharnaisius Mariæ, Gould, Monogr. Ramph. Instr. p. 22 (2d ed. 1854).

Gould, Monogr. Ramph., 2d ed. pl. 30.

Much resembling the preceding, but smaller, and with the under mandible entirely dull orange or ochre color (not with a stripe only of that color on the lower mandible, as in *P. Azaræ*). Other colors as in *P. flavirostris*.

Total length 14 inches (Gould).

Hab.—Amazon River. Spec. in Mus. 7

This species I have not seen.

19. *PTEROGLOSSUS AZARÆ* (Vieillot).

Ramphastos Azara, Vieill. Nouv. Dict. xxxiv. p. 282 (1819).

Pteroglossus nigridentis, Temm. Man. d'Orn. i. p. 75 (1820).

Gould, Monogr. Ramph. 2d ed. pl. 28. Vieill. Gall. Supp. pl. 16. Le Vaill. Ois. Par. Supp. pl. A.

Resembling the two species immediately preceding, *P. flavirostris* and *P. Mariæ*, but with a wide longitudinal band in the upper mandible of orange-red; under mandible yellow. Colors of plumage as in *P. flavirostris*, and about the same size.

Total length 14 $\frac{3}{4}$ inches (Gould).

Hab.—Amazon River (Gould).

This species I have not seen.

4. *Beauharnaisius*.

Genus *Beauharnaisius*, Bonap. Comp. Av. i. p. 95 (1849).

20. *PTEROGLOSSUS BEAUHARNAISIUS*, Wagler.

Pteroglossus Beauharnaisii, Wagl. "Unterh. das Ausland, 1830, p. 450."

Pteroglossus Præpigi, Wagl. Isis, 1832, p. 1230.

Pteroglossus lepidocephalus, Nitzsch. Pterylog. p. 136 (1840).

Pteroglossus ulocomus, Gould, Proc. Zool. Soc. London, 1833, p. 28.

Gould, Monogr. Ramph. 1st ed. pl. 18, 2d ed. pl. 25.

Differs from all other species in having the feathers of the head changed into a singular tissue resembling horn or whalebone, which are curled on the top of the head, flattened or spatulate on the occiput, and black (on the head above). Throat and sides of the neck with similar horn-like feathers, which are straight, and white, tipped with black. Back of the neck and rump carmine; back, wings and tail dark green. Breast yellow, with numerous small spots of scarlet; sides and a wide band on the abdomen scarlet; middle of the abdomen yellow; tibia green.

Total length 16 to 18 inches.

Hab.—Northern South America, Upper Amazon. Spec. in Mus. Acad., Philada.

A curious bird, easily recognized by its most singular head-gear, which has the appearance of being composed of curled shavings of horn or whalebone of a lustrous black color. Rare in American collections, but stated to be common enough in the countries on the Rio Amazonas. Specimens in Acad. Mus. were received from European dealers.

5. *Baillonius*.

21. *PTEROGLOSSUS BAILLONI* (Vieillot).

Ramphastos Bailloni, Vieill. Nouv. Dict. xxxiv. p. 283 (1819).

[Sept.

Pteroglossus croceus, Jard. and Selb. Ill. Orn. i. (no page nor date.)

Gould, Monogr. Ramph. 1st ed. pl. 20, 2d ed. pl. 41. Le Vaill. Ois. Parad. ii. pl. 18. Jard. and Selb. Ill. Orn. i. pl. 6.

A singular and anomalous form, not related specifically to any other. Head and entire under parts saffron-yellow. Rump crimson; upper parts of body, wings and tail yellowish-green. Sexes alike.

Total length about 15 to 16 inches.

Hab.—Central and Eastern South America, Brazil. Spec. in Mus. Acad. Philada. and Mus. Smiths. Washington.

Quite common in collections from Brazil. This peculiar and oddly-colored species seems to be most properly arranged here, though usually rated as an *Andigena*. It does not intimately resemble any other species of Toucan.

The following may be an additional species of *Pteroglossus*, but is doubtful, and unknown to modern naturalists.

25. *PTEROGLOSSUS ALDROVANDI* (Shaw), Wagler, Syst. Av. sp. 1 (1827).

Ramphastos Aldrovandi, Shaw, Gen. Zool. viii. p. 366 (1811).

Ramphastos picatus, Linn. Syst. Nat. i. p. 152 (12th ed. 1776)?

Albin's Birds, ii. pl. 25.

"This bird is little bigger than the common *Maggie*; the head, neck, and upper part of the back towards the neck, are black; the rest of the back and wings show something of a cinereous whiteness. The breast shines with a most bright and lovely gold or saffron color, with a certain redness near the beginning; the belly and thighs of a most beautiful vermilion or scarlet color. The red color reaches almost half-way of the tail, and is intercepted by a broad bar of black, and ending in a beautiful red; the legs, feet and claws are black."

"Its bill is very large, considering the bigness of the bird; its length was six inches, breadth at the upper part towards the head two inches and a quarter, the circumference at the same place five inches and a half; the upper chap is large and somewhat hooked, with a cavity exactly fitting the under chap, both serate (*sic*) or toothed, and of a thin bony substance, and a covering over that of a horny-like scale, both very thin and light, weighing but eight drachms. It was of a yellowish color, clouded with a darkish green, towards the end or point reddish; its nostrils were situate just above the horny substance of the bill, adjoining to the head, which is large and thick, as is suitable and requisite to sustain a bill of that length and bigness."—A Natural History of Birds, illustrated with two hundred and five copper plates curiously engraven from life, and exactly colored by the author, Eleazer Albin. To which are added Notes and Observations by W. Derham, D. D., Fellow of the Royal Society. London, 1738 (vol. ii. p. 24).

The peculiarities of the bird here described are the abdomen and thighs being scarlet, and the tail being scarlet at base and tipped with "beautiful red." The plate, "exactly colored," seems to represent a *Pteroglossus*, but of a species quite unknown, and, in fact, has much the appearance of a fictitious specimen, though Albin, as above (ii. p. 24), intimates that he has seen it living. It is the sole authority for the species.

III. Genus SELENIDERA, Gould.

Genus *Selenidera*, Gould, Icon. Av. pt. i. (1837).

1. *Selenidera*.

1. *SELENIDERA MACULIROSTRIS* (Lichtenstein).

Pteroglossus maculirostris, Licht. Verz. p. 7 (1823).

Ramphastos maculatus, Vieill. Gal. Ois. ii. Supp. p. (1834).

Gould, Monogr. Ramph. 1st ed. pl. 24, 2d ed. pl. 31. Vieill. Gal. ii. Supp. pl. 14, 15. Jard. and Selby, Ill. Orn. i. pl. 26. Le Vaill. Ois. Par. pl. 15, Supp. pl. A.A.

1867.]

With this species we again enter upon a group resembling each other in colors of plumage, but distinguished by different colors and markings of the bills. All the species are smaller than in either of the preceding groups, *Ramphastos* or *Pteroglossus*, and form apparently a natural and readily defined group, probably generic. All the species are singularly alike in colors of plumage, and are nearly of the same size. They are, without exception, represented with extraordinary accuracy in Mr. Gould's Monograph of the Family *Ramphastidae*. The ear coverts are yellow in all known species of this group, and present an immediately available generic character.

Adult ♂. Bill pale bluish or greenish-white, darker on the culmen and at the base; upper mandible with about four or five irregular transverse bars of black, the last of which (nearest the tip) extends to the under mandible also, forming a very distinct and nearly perfect transverse band across both mandibles near the end. Head, neck and breast glossy black; ear coverts orange nearest the eye, pale yellow posteriorly. Narrow band of yellow on the back of the neck; back, wings and tail dark olive-green, tinged somewhat with yellowish on the back and rump. Flanks with a large spot of orange; abdomen yellowish-green; under tail coverts scarlet. About six middle tail feathers, tipped with chestnut. Feet greenish-brown.

Adult ♀. Head, neck and breast reddish-chestnut; otherwise much as in the male.

Total length about 12 to 13 inches; wing 6 to 6½, tail 4½ to 5, bill (chord) 2½ inches.

Hab.—Central and eastern Brazil, Rio de Janeiro, St. Katharines, Bahia. Spec. in Mus. Smiths. Washington, and Mus. Acad. Philada.

Abundance of specimens of this species in Smiths. Mus. and Acad. Mus., but not specially stating locality; nor is there any specimen in young or immature plumage. It is brought commonly from Brazil.

2. SELENIDERA GOULDII (Natterer).

Pteroglossus Gouldii, Natt. Proc. Zool. Soc. London, 1837, p. 44.

Gould, Monog. Ramph. 2d ed. pl. 32. Icon. Av. pl. 7.

Much resembling the preceding, and about the same size, but with the basal half to two-thirds of the upper mandible black (not with transverse bars or bands, as in that species, *S. maculirostris*.) Under mandible with one transverse band near the tip. Large spaces on the flanks deeper orange.

♀. Very nearly as in *S. maculirostris*, but with the upper mandible black at base, as in the male.

Total length 12 to 13 inches.

Hab.—Northern South America, Para, Rio Amazona. Spec. in Mus. Acad. Philada.

Easily distinguished by the black of the upper mandible, and inhabits more northern regions of South America than *S. maculirostris*. Specimens in Acad. Mus. labelled "Para" and "Rio Amazona," the latter from Mr. Wallace's collections.

3. SELENIDERA LANGSDORFFII (Wagler).

Pteroglossus Langsdorffii, Wagl. Syst. Av. (1827.)

Gould, Monog. Ramph. 1st ed. pl. 28, 2d ed. pl. 33.

Resembling the preceding two species, but with the bill entirely bluish-black, paler at base, especially of the under mandible. Colors of the plumage much as in the preceding, in both sexes.

Total length about 12 to 13 inches.

Hab.—Western South America, Peru, Amazon River (Lieut. Herndon). Spec. in Smiths. Mus. Washington, and Mus. Acad. Philada.

This species has the upper mandible uniform bluish-black or dark horn-color, paler at base; under mandible with the paler base extending to one-half to two-thirds of its length, bluish-black in the terminal portion. Easily distinguished from the two preceding or other species by these colors of the bill. Lieut. Herndon's specimens in Smiths. Mus. are labelled "Amazon River," but as he crossed the continent on the route of that river, they are probably from its western or head waters. Other specimens in Acad. Mus. are from Peru.

4. SELENIDERA REINWARDTII (Wagler).

Pteroglossus Reinwardtii, Wagl. Syst. Av. (1827.)

Gould, Monog. Ramph. 1st ed. pl. 26, 2d ed. pl. 34.

[Sept.

Like the preceding, but with the bill dull red in the basal two-thirds of both mandibles; terminal one-third bluish-black. Plumage in both sexes much as in the preceding. Size perhaps rather larger.

Total length $12\frac{1}{4}$ to $13\frac{1}{4}$ inches.

Hab.—Western South America, Peru, Ecuador? Spec. in Mus. Acad. Philada.

Having an entirely peculiar coloring of the bill, and inhabiting western and perhaps north-western South America. Mr. Gould mentions a specimen which was probably from the country on the Rio Napo. Specimens in Acad. Mus. are from Peru.

5. *SELENIDERA NATTERERI* (Gould).

Pteroglossus Nattereri, Gould, Proc. Zool. Soc. London, 1835, p. 157.

Gould, Monog. Ramph. 1st ed. pl. 25, 2d ed. pl. 35.

Bill red, but with culmen green, and with several irregular transverse bars of greenish-black across both mandibles, widest at the base. Ear coverts pale yellow nearest the eye, orange posteriorly (the reverse of all the preceding species). Chestnut color of the tibiae extending on the flanks. Plumage generally as in all the preceding in both sexes.

Total length 12 to 13 inches.

Hab.—Northern South America, Rio Negro, British Guiana. Spec. in Mus. Acad. Philada.

Differing again from all of the preceding in the colors of the bill, and having the colors of the ear spot reversed, as above described. Spec. in Acad. Mus. labelled as above.

2. *Piperivorus*.

Genus *Piperivorus*, Bonap. Ois. De Lattre, p. 84 (1854).

6. *SELENIDERA PIPERIVORA* (Linnæus).

Ramphastos piperivorus, Linn. Syst. Nat. i. p. 103 (1758).

Pteroglossus culik, Wagl. Syst. Av. (1827.)

Gould, Monog. Ramph., 1st ed. pl. 27, 2d ed. pl. 36. Buff. Pl. Enl. 577, 729. Edwards Birds, vii. pl. 330. Le Vaill. Ois. Parad. pl. 13, 14.

This species, though having in the male the same general colors of plumage as all the preceding species of the genus *Selenidera*, differs in the bill being longer and more strongly curved, and the plumage of the female is different from that of those species, and quite peculiar. The bill somewhat approaches that of *Pteroglossus*, and this species may be regarded as an analogue of that group in the present, just as the next species represents *Ramphastos*. This species, undoubtedly, as Mr. Gould remarks with his usual accuracy and excellent judgment, is properly to be retained in this genus.

Adult ♂. Upper mandible red at base, with its terminal seven-eighths black; under mandible with its basal one-half red, and its terminal one-half black (base of bill dull reddish-yellow in dried specimens). Ear spot yellow, or very slightly tinged with orange. Large space on the flanks yellowish-green, scarcely distinguishable in some specimens. Other plumage as in the preceding, but with the green of the upper parts darker. All the tail feathers tipped with chestnut.

Total length $12\frac{1}{4}$ to $13\frac{1}{4}$ inches.

Adult ♀. A wide space on the neck behind chestnut; top of the head black. Back, wings and tail green, the back with a yellow tinge. Throat, neck before and breast fine bluish-gray, with a greenish tinge running into yellowish-green on the abdomen. Tibiæ chestnut, generally mixed with green; under tail coverts scarlet; tail feathers tipped with chestnut. Legs greenish-brown.

Hab.—Northern South America, Guiana, Cayenne, Rio Amazons. Spec. in Mus. Acad. Philada.

Numerous specimens in Acad. Mus., labelled as above.

3. *Ramphastoides*.

7. *SELENIDERA SPECTABILIS*, Cassin.

Selenidera spectabilis, Cass. Proc. Acad. Philada. 1857, p. 214.

Jour. Acad. Philada. iv. pl. 1 (quarto).

The largest species of this genus, and with the bill larger and wider vertically. Easily distinguished from either of its congeners by its size and the colors of the bill, though having the same general colors of plumage. Ear coverts yellow.

1867.]

Adult ♂. Colors of the upper mandible divided obliquely by a line from below the nostril to the edge of the upper mandible within its terminal one-third. Upper portion and tip greenish-yellow (in dried specimen); lower portion and under mandible greenish-black, paler at base. Bill at base with a line of black (as in species of *Ramphastos*). Ear spot light yellow; flank with a large spot of orange-yellow. Head, neck and body below glossy black; back and wings dark olive-green. Under tail coverts scarlet; tibiae chestnut. Tail greenish-blue, with gray tinge (uniform, and having no chestnut tips). Legs bluish-brown.

Adult ♀. Bill as in the male. Head above and neck behind dark chestnut; other plumage as in the male.

Total length about 15 inches; wing $5\frac{1}{2}$, tail 5, bill (chord) 4 inches.

Hab.—Northern South America, Central America, "Cocuyas de Veragua, New Grenada" (Mr. Robert W. Mitchell), "Province of Choco, New Grenada" (Mr. W. S. Wood, Jr.), Costa Rica (Mr. J. Carmiol). Spec. in Mus. Smiths. Washington, and Mus. Acad. Philada.

Specimens in Smiths. Mus. are in the valuable collections of Mr. Julian Carmiol, from Costa Rica, and from Captain Michler's collection from the Rio Atrato. Mr. Mitchell's type specimens in Acad. Mus. are from New Grenada, as above.

IV. Genus AULACORAMPHUS, G. R. Gray.

Genus *Aulacoramphus*, G. R. Gray, List Gen. 1840, p. 50.

Aulacorhynchus, Gould, Proc. Zool. Soc. London, 1834, p. 147.

1. *Aulacoramphus*.

1. *AULACORAMPHUS SULCATUS* (Swainson).

Pteroglossus sulcatus, Swains. Jour. Roy. Inst. ix. p. 267.

Swains. Zool. Ill. i. pl. 44. Temm. Pl. Col. 356. Gould, Mon. Ramph., 1st ed. pl. 31, 2d ed. pl. 42.

Entire plumage grass-green, darker on the upper parts of the body, wings and tail lighter, and tinged with yellow on the under parts; throat bluish or grayish-white; cheeks and narrow stripe over the eye blue. (Rump green, uniform with the back.) Both mandibles with wide, very distinct grooves throughout their length. Upper part of upper mandible and tip of under mandible brownish-red; lower part of upper mandible black. Under mandible, at base, red (tip brownish-red); intermediate space black. Legs greenish-brown. Tail bluish at the end (not tipped with reddish-brown, as in the next succeeding).

Total length about 13 inches; wing $4\frac{1}{2}$ to $5\frac{1}{2}$, tail 5, bill (chord) $2\frac{1}{2}$ to 3 inches.

Hab.—Northern South America, Venezuela, "Caraccas." Spec. in Mus. Acad. Philada.

Easily distinguished by the grooved or *sulcate* bill, but especially that character in the under mandible. In the specimens now before me there is considerable difference in size, and especially in that of the bill; and in one specimen, obtained at Caraccas, the bill measures $2\frac{1}{2}$ inches, wing $4\frac{1}{2}$ inches. In the largest specimen the bill is 3 inches, wing $5\frac{1}{2}$ inches. Several specimens in Acad. Mus.

This species is the type of a group, undoubtedly generic, first indicated by Mr. Gould under the name *Aulacorhynchus*, but which, having been previously used, was changed by Mr. Gray to *Aulacoramphus*, as above. It is a singularly uniform group in coloring, all of the eleven species at present known being of grass-green and yellow colors, though the species are for much the greater part more strongly distinct from each other than in any other group of this family. My present impression is that size is an uncertain character in this genus, and more variable, and generally so, in the same species than usual.

2. *AULACORAMPHUS DERBIANUS* (Gould).

Aulacorhynchus Derbianus, Gould, Proc. Zool. Soc. London, 1835, p. 49.

Gould, Mon. Ramph. 1st ed. pl. 32, 2d ed. pl. 43.

Upper mandible only *sulcate*; occiput with a wide transverse band of pale blue; longer tail feathers tipped with reddish-chestnut. (Rump green, uniform with the back.) Both mandibles at base brownish-red; tip of upper mandible red; intermediate space of both mandibles black. Entire other plumage grass-green; throat bluish or grayish-white; cheeks blue; line over the eye bluish-white; line at base of bill white, and very conspicuous. Larger than the preceding.

Total length about 14 to 15 inches.

Hab.—Western South America, Peru (Dr. W. S. W. Ruschenberger, U. S. Navy), "Columbie" (Mr. J. P. Verreaux's label), Bolivia (Mr. Gould).

[Sept.

Resembling the preceding in colors, but easily distinguished by the large occipital band of pale blue, and has the longer tail feathers tipped with chestnut (which is not the case in the preceding, *A. sulcatus*). The under mandible is not grooved, as in the preceding.

Of this species, specimens from Peru seem to have the bills darker than in others labelled as from "Columbie" in Mr. Jules Verreaux's hand-writing, though otherwise quite similar. In the Acad. Mus. there are specimens in very fine plumage from the "Province of Curco, Peru," in the valuable collections presented by Dr. W. S. W. Ruschenberger, of the United States Navy.

3. *AULACORAMPHUS CASTANEO RHYNCHUS* (Gould).

Pteroglossus (Aulacorhynchus) castaneorhynchus, Gould, Ann. and Mag. Nat. Hist. 1842, p. 238.

Aulacoramphus castaneirostris, Bonap. Ois. Delattre, p. 84 (1854).

Gould, Mon. Ramph. 2d ed. pl. 44.

Larger. Bill fine chestnut-red, culmen usually black; large space in middle of under mandible usually black; line of white at base of bill wide and very distinct, especially on under mandible. Rump scarlet; longer feathers of the tail widely tipped with brownish-chestnut. Entire plumage grass-green, with a golden tinge on the neck behind and back, paler and strongly tinged with blue on the under parts, especially the breast; middle tail feathers strongly tinged with blue; cheeks and small spot over the eye blue.

Total length about 17 to 19 inches.

Hab.—Northern South America, New Grenada, "Bogota." Spec. in Mus. Acad. Philada.

The largest species of this group. Much resembling the preceding, *A. Derbyanus*, but with the rump scarlet. In three specimens now before me in Acad. Mus., no two are exactly similar in the colors of the bill, and one only corresponds in that respect with Mr. Gould's beautiful plate of this species. In two others a band of black is strong and well-defined on the culmen and on the middle of the lower mandible. In the one specimen the black of the culmen is much more restricted and less clearly defined, and the under mandible almost entirely black.

Easily distinguished from either of the preceding by its scarlet rump and larger size. Specimens in Acad. Mus. from Bogota.

4. *AULACORAMPHUS HÆMATOPYGUS* (Gould).

Pteroglossus hæmatopygus, Gould, Proc. Zool. Soc. London, 1834, p. 147.

Gould, Mon. Ramph. 1st ed. pl. 33, 2d ed. pl. 45.

Like the preceding, *A. castaneorhynchus*, but smaller, and with a shorter and stouter bill. Total length 14 inches (Mr. Gould).

Hab.—Ecuador. Spec. in coll. Mr. John Gould, and Dr. P. L. Selater, London.

In the large collection now under examination I have no specimen which exactly corresponds with Mr. Gould's plate and description, but I do not find any characters which might not readily be found in the young of the preceding, *A. castaneorhynchus*, especially in view of the liability to variation which seems to prevail in this group. One specimen only known to Mr. Gould, but this species is given by Dr. Selater in List of Birds from Pallatanga, Ecuador. (Proc. Zool. Soc., London, 1859, p. 146).

5. *AULACORAMPHUS CÆRULEICINCTUS* (D'Orbigny).

Aulacoramphus cæruleicinctus, D'Orb. Voy. Am. Ois. p. 382 (1844).

Pteroglossus Lichtensteini, Sturm ed. Gould's Monog. (not paged, 1845).

D'Orb. Voy. Am. Mer. Ois. pl. 66. Gould, Mon. Ramph. 2d ed. pl. 46.

Large; bill dark bluish horn-color, with the tip and edges of both mandibles yellowish-white. Wide transverse band on the breast pale blue. Rump red; tip of longer tail feathers brownish-chestnut; throat bluish-white; cheeks blue; line over the eye bluish-white. Entire other plumage grass-green, tinged with yellow on the abdomen and under tail coverts.

Total length from 14 to 16 inches.

Hab.—Western South America, Bolivia, "Columbie." Spec. in Mus. Acad. Philada. and Mus. Smiths. Washington.

The bluish or horn color of the bill is peculiar, and immediately available in the recognition of this species. Five specimens in Mus. Acad. differ in size 1867.]

and also in length and thickness of bill, two specimens from D'Orbigny's collections being the smallest, and probably not adult. These last are from "Yungas, Bolivia." Others are labelled "Columbie," in the hand-writing of Mr. Jules Verreaux. The wide pectoral band of pale blue is also a strong and peculiar feature in this species.

One specimen of this fine species is in the very interesting and valuable collection presented to the Smithsonian Institution by the Hon. D. K. Cartter, of Washington, D. C., and made by him while Minister of the United States to the republic of Bolivia.

2. *Ramphoxanthus*.

Genus *Ramphoxanthus*, Bonap. Ois. De Lattre, p. 84 (1854).

6. *AULACORAMPHUS PRASINUS* (Gould).

Pteroglossus prasinus, Gould, Monog. Ramph. 1st ed. p. (1834).

"*Pteroglossus prasinus*, Lichtenstein," Gould, as above.

Gould, Mon. Ramph. 1st ed. pl. 29, 2d ed. pl. 47.

Upper mandible yellow, with a longitudinal stripe on its cutting edge black; spot at the base of the culmen black, passing into chestnut-red anteriorly, and a small irregular spot of black below the nostril; under mandible black. Under tail coverts chestnut, and all the tail coverts tipped with chestnut. Throat and cheeks white, frequently tinged with yellowish or bluish. Entire other plumage grass-green, tinged with golden on the head and neck behind, and with blue on the under parts of the body, at the ends of the shorter quills, and towards the ends of the longer tail feathers.

Total length 13 to 14½ inches; wing 5, tail 5 to 5½ inches.

Hab.—Mexico, Jalapa (Mr. D'Oca), Orizaba (Prof. F. Sumichrast), Mirador, near Vera Cruz (Dr. C. Sartorius), Guatemala, Cohan, Clusec (Mr. Henry Hague). Spec. in Mus. Acad. Philada. and Mus. Smiths. Washington.

An abundant species in American collections, and contained in all the various and interesting collections from Jalapa, Mexico, sent to the United States by Mr. Raphael Montes D'Oca. Also, usually in the very fine collections from Orizaba sent by Prof. Sumichrast, and from Mirador by Dr. Sartorius, to the Smithsonian Institution. Specimens in the Smiths. Museum from "Central Guatemala" are in a very valuable collection made by Mr. Henry Hague.

This is the first of several species in which the upper mandible is yellow, as above described. Very handsomely figured by Mr. Gould, as above cited. The line at the base of the bill in this species is yellow.

7. *AULACORAMPHUS WAGLERI* (Sturm).

Pteroglossus Wagleri, Sturm, ed. Gould's Mon. Ramph. (not paged, 1845).

Pteroglossus pavoninus, Gould, Proc. Zool. Soc. London, 1835, p. 158.

"*Pteroglossus pavoninus*, Mus. Mun.," Gould, as above.

Gould, Mon. Ramph. 1st ed. pl. 30, 2d ed. pl. 48.

Like the preceding, *A. prasinus*, but with the base of the upper mandible black (yellow in *A. prasinus*), and the line at the base orange-yellow.

Total length about 14 inches.

Hab.—Mexico? Spec. in Imp. Mus. Vienna.

This species I have not seen, but from Mr. Gould's and Mr. Sturm's descriptions and figures I have no doubt that it is an entirely valid and respectable species.

8. *AULACORAMPHUS ALBIVITTATA* (Boissonneau).

Pteroglossus albivitta, Boiss. Rev. Zool. 1840, p. 70.

Pteroglossus microrhynchus, Sturm, Mon. Ramph. (name on plate).

Gould, Mon. Ramph. 2d ed. pl. 49.

Like the two immediately preceding, *A. prasinus* and *A. Wagleri*, but with a wide transverse band at base of the bill, white and conspicuous (narrow and yellow in those species). Upper part of upper mandible yellow, lower part black; a narrow band across the culmen brownish-black. Plumage as in *A. prasinus*.

Total length about 13 inches.

Hab.—Northern South America. New Grenada, Bogota. Spec. in Mus. Acad. Philada. and Mus. Smiths. Washington.

[Sept.

Frequently received in Bogota collections, and several specimens in Acad. Mus. are labelled "Columbie" in Mr Verreaux's hand-writing. Much resembling the two preceding, especially *A. prasinus*, but easily recognized by its white band at the base of the bill. The black portion of the under mandible is also much wider.

9. *AULACORAMPHUS ATROGULARIS* (Sturm).

Pteroglossus atrogularis, Sturm ed. Gould's Mon. Ramph. (not paged, 1845). Gould, Mon. Ramph. 2d ed. pl. 50.

Throat black. Upper part of upper mandible yellow, lower part black; upper mandible with a line of white at base, frequently tinged with yellow, or with a line of white and another of yellow at base. Under mandible black, with a wide line of white at base, sometimes tinged with yellow. Colors generally as in *A. prasinus* and *A. bivitatus*.

Total length $12\frac{1}{2}$ to 15 inches.

Hub.—Western South America, "Peru, Ecuador" (Mr. Gould), "Columbie" (Mr. Verreaux's label). Spec. in Mus. Acad. Philada.

The peculiarity of this species is the black throat, which character is strongly defined in two specimens in Acad. Mus., but in one other the throat is black, tinged and edged with blue. This specimen is, however, evidently not adult.

10. *AULACORAMPHUS CÆRULEOGULARIS*, Gould.

Aulacoramphus cæruleogularis, Gould, Proc. Zool. Soc. London, 1853, p. 45.

Gould, Mon. Ramph. 2d ed. pl. 51.

Throat and cheeks blue. Upper mandible with a wide transverse band of reddish-chestnut at base, and also a longitudinal band of black in the basal one-third of the culmen. Upper part of upper mandible yellow, lower part black; under mandible black; a wide line at base of bill yellow in upper mandible, wider and white in the lower mandible. Inferior tail coverts chestnut; all the tail feathers tipped with chestnut. Entire other plumage grass-green, strongly tinged with golden on the head, and with yellow on the abdomen. Legs bluish-brown.

Total length about $12\frac{1}{2}$ to 14 inches; wing $4\frac{1}{2}$ to 5, tail $4\frac{1}{2}$, bill (chord) $2\frac{3}{4}$ to 3 inches.

"Iris black, length 14 inches" (Dr. A. von Frantz). "Iris brown, length $14\frac{1}{2}$ inches" (Mr. J. Carmiol). "♀. length 13 inches."

Hub.—Costa Rica, "Berrin," "La Palma," "San Jose" (Dr. A. von Frantz), "Dota," "Barranca," "Turrialba" (Mr. J. Carmiol), Veragua (Mr. Gould). Spec. in Mus. Smiths. Washington.

Numerous specimens in the Smiths. Coll., exclusively from Costa Rica. This species strongly resembles the immediately preceding, *A. atrogularis*, but has the throat blue instead of black, and the plumage of the head is glossed with golden yellow, and in other respects it is quite distinct and easily recognized. Seems to be the most abundant species of Toucan inhabiting Costa Rica.

11. *AULACORAMPHUS CYANOLÆMUS*, Gould.

Aulacoramphus cyanolæmus, Gould, Proc. Zool. Soc. London, 1866, p. 24.

"Male. Bill black, with a small mark of yellow at the tip of the upper mandible, and a band of white at the base of both mandibles, except on the culmen; this white band is much narrower on the upper than on the under mandible, and moreover has the posterior half of its breadth pale yellow. Naked skin around the eyes dull red; throat grayish-blue, approaching to violet, and becoming of a deeper tint where it joins the green of the neck; a tinge of blue also appears at the base of the ear coverts, towards the bill, and over the eye, where, however, it becomes of a greener hue. Plumage of the head and body deep grass-green, with a wash of yellow on the flanks; primaries black, edged with brown; under surface of the wing pale yellow; tail feathers deep green, conspicuously tipped with chestnut; under tail coverts chestnut-brown; legs green."

"Total length of male 12 inches; bill $2\frac{3}{8}$, wing $5\frac{1}{8}$, tail $5\frac{1}{8}$, tarsi $1\frac{1}{8}$."

"Female. Precisely similar in color, but, as is the case with all the other species of the genus, much smaller than the male."

Hub.—Loxa in Ecuador."

Remark.—This well marked species is allied to the *Aulacoramphus cæruleogularis* of Panama and the *A. atrogularis* of Peru, but differs from the former in the smaller extent of blue on the throat, from the latter in having no trace of black on that part, and from both in the markings of the bill." (Mr. Gould.)

This is Mr. Gould's description, but the species is unknown to me.

1867.]

V. Genus ANDIGENA, Gould.

Genus *Andigena*, Gould, Proc. Zool. Soc. London, 1850, p. 93.1. *Andigena*.1. *ANDIGENA HYPOGLAUCUS* (Gould).*Pteroglossus hypoglaucus*, Gould, Proc. Zool. Soc. London, 1833, p. 70.
Gould, Mon. Ramph. 1st ed. pl. 19, 2d ed. pl. 38.

Bill with its basal one-half yellow, enclosing a nearly triangular spot of black near the base; terminal portion of upper mandible red; terminal portion of the under mandible black. Head above black; back and wing coverts reddish-brown; rump yellow; outer webs of quills dark green. Under parts and band around the neck light blue or bluish-gray; tibiae chestnut; under tail coverts scarlet; tail greenish-black, the four middle feathers tipped with chestnut; legs bluish-brown.

Total length 17 to 18 inches; wing $6\frac{1}{2}$, tail $6\frac{1}{2}$ to 7, bill 4 inches.

Hab.—Western South America, Peru (Hon. J. Randolph Clay), "Columbe" (Mr. J. Verreaux's label). Spec. in Mus. Acad. Philada.

This is an oddly colored species, two specimens of which in the Acad. Mus. are all that I have seen. One specimen in excellent plumage is in the interesting collection made by the Hon. John Randolph Clay in Peru, while Minister of the United States to that country; and the other was received from the establishment of the Messrs. Verreaux, Paris. These specimens have the bills differing somewhat in size and length, but are otherwise quite similar.

This is the type of a very peculiar group, certainly of generic value, and so described and named as above by that great naturalist, Mr. John Gould, of London. All of the known species are of rather plain but grotesque and oddly arranged colors. This lot is evidently what my lamented and accomplished friend and associate, the late Dr. Wilson, was accustomed to call "the *eccentric* type" of the Toucans.

2. *ANDIGENA LAMINIROSTRIS*, Gould.*Andigena laminirostris*, Gould, Proc. Zool. Soc. London, 1850, p. 93.
Gould, Mon. Ramph. 2d ed. pl. 37.

Bill with a raised plate or lamina of yellow in its basal half; band at base of bill red, other parts of bill, black. A large spot on each flank orange-yellow. Head above and neck behind black; back and wings light brown or snuff-color; rump greenish-yellow. Under parts light blue; tibiae dark chestnut; under tail coverts scarlet; tail bluish-black, the four middle feathers tipped with chestnut; legs bluish-brown.

Total length about 18 inches; wing $6\frac{1}{2}$ to 7, tail $6\frac{1}{2}$ to 7, bill $3\frac{1}{2}$ inches.

Hab.—Ecuador (Hon. Charles R. Buckalew). Spec. in Mus. Acad. Philada. and Mus. Smiths. Washington.

Strongly characterized by the curious raised plate in the basal half of the upper mandible. The colors of the plumage in this strange Toucan resemble those of the preceding, *A. hypoglaucus*, but differ entirely in the bill, and in the present bird there is no extension of the color of the under parts around the neck behind, and it has large spots of orange on the flanks.

The fine collection made in Ecuador by that accomplished gentleman and statesman, the Hon. Charles R. Buckalew, late Minister of the United States to that country, and now United States Senator from Pennsylvania, contained several excellent specimens of this curious bird, very similar in their colors and other characters. Mr. Buckalew's collection was presented by him to the Smithsonian Institution.

3. *ANDIGENA CUCULLATUS* (Gould).*Pteroglossus cucullatus*, Gould, Proc. Zool. Soc. London, 1846, p. 69.
Gould, Mon. Ramph. 2d ed. pl. 40.

Much resembling *A. hypoglaucus*, but with the bill yellow in its basal two-thirds and black in its terminal one-third; under mandible with a black spot near its base. Tail black (not tipped with chestnut). Plumage nearly as in *A. hypoglaucus*.

Total length about 18 inches.

Hab.—Bolivia. Spec. in Brit. Mus. London.

This species is not in any American collection, to my knowledge, and seems to

[Sept.

be only known from three specimens obtained in Bolivia by Mr. Thos. Bridges, and now or recently in British collections. I am not without a suspicion that this bird is the young of *A. hypoglaucus*, which, judging from Mr. Gould's excellent plate and description, it closely resembles, except in the colors of the bill.

2. *Ramphomelas*.

Genus *Ramphomelas*, Bonaparte, Ois. De Lattre, p. 84 (1854).

4. *ANDIGENA NIGRIROSTRIS* (Waterhouse).

Pteroglossus nigrirostris, Waterh. Proc. Zool. Soc. London, 1839, p. 111.

Pteroglossus melanorhynchus, Sturm, ed. Gould's Mon. Ramph.

Gould, Mon. Ramph. 2d ed. pl. 39.

Bill black. Head above and neck behind black; back and wing coverts sienna-brown; upper tail coverts pale yellow. Throat and sides of the neck bluish-white; under parts of body pale blue; under tail coverts scarlet; tibiae dark chestnut; quills greenish-black, edged externally with brown; tail bluish or greenish-black, the longer feathers tipped with chestnut; legs greenish-black.

Total length 18 to 19 inches; wing $6\frac{1}{2}$ to 7, tail 8, bill 4 to $4\frac{1}{2}$ inches.

Hab.—Northern South America, Bogota, "Columbie." Spec. in Mus. Acad. Philada.

Easily recognized by its entirely black bill, and not intimately resembling either of its preceding congeners. Specimens in Mus. Acad. were received from Europe, and are labelled "Bogota" and "Columbie."

5. *ANDIGENA SPILORHYNCHUS*, Gould.

Andigena spilorhynchus, Gould, Proc. Zool. Soc. London, 1858, p. 149.

"Crown of the head and back of the neck glossy black; back, wing coverts and margins of the primaries dull sienna brown, secondaries bluish-brown; upper tail coverts blue, strongly tinged with green; tail slaty-blue, tinged with green, the four central feathers largely tipped with chestnut; band across the rump sulphur-yellow. Throat and cheeks white, blending into the light blue of the breast and abdomen; thighs rich chestnut; under tail coverts blood-red; feet greenish-blue, with a lilac tinge on their under surface; bill black, with a mark of obscure brownish-red at the base of the upper mandible, which, when viewed in front, much resembles the letter W; this color advancing for a short distance on each side of the culmen, and extending down the sides of the base."

"Total length 18 inches; bill $3\frac{1}{2}$, wing 7, tail $7\frac{1}{2}$, tarsi $1\frac{1}{2}$."

Hab.—Forests of Beza, on the eastern side of the Cordillera, in Ecuador."

"Differs from *A. nigrirostris* in the bill being shorter, broader and much more robust, and colored with obscure brownish-red at the base of the upper mandible."

One specimen in Acad. Mus. seems to approach this description, but not sufficiently. It may be the young of *A. nigrirostris*. Dr. Sclater possesses specimens from the Rio Napo, Ecuador, and says: "scarcely different from *A. nigrirostris*." (Cat. Am. B. p. 327.)

The following have been described as species of *Ramphastos*, but are either not so, or the descriptions are not sufficient:

1. *RAMPHASTOS ALBUS*, Gm. Syst. Nat. i. p. 357 (1788).

White Toucan, Lath. Syn. i. p. 336.

"All that we know of this species is that the bird is wholly of a pure white, and that it is now, or was very lately, alive in the menagerie of the King of Naples." Which small matter of information has in nowise increased that I know of. Not given by Latham in Gen. Hist., subsequently published.

2. *RAMPHASTOS PULCHER*, Müll. Syst. Nat. Supp. p. 84 (1776).

Ramphastos pavoninus, Gm. Syst. Nat. i. p. 353 (1788).

Tucana Mexicana viridis, Briss. Orn. iv. p. 423 (1760).

Xochitenucatl, Hernandez, His. Nov. Hisp. p. 51 (1651).

"Avis est Psittaci magnitudine et forma, ac pene tota viridis, insertis tamen nonnullis pennis rubescentibus, pauoninisque aliis; verum crura, pedesque nigra sunt et tenuia; rostrum incurvum, quaternas pene uncias longum, serratumque, unde nomen, et luteo, ac nigro varium colore; calidarum regionum atque maritimarum Incola est, neque alium (quod nouerim) quam plumae praestat vsum." Hernandez, as above.

This description has been done into various languages by competent hands, but remains the sole authority for the species. It seems to be more like a Trogon than a Toucan.

3. *RAMPHASTOS FLAVUS*, Müll. Syst. Nat. Supp. p. 84 (1776).

Ramphastos luteus, Gm. Syst. Nat. i. p. 353 (1788).

Tucana lutea, Briss. Orn. iv. p. 432.

"*Tucana dilute lutea*; taenia utrinque longitudinali a rostro ad pectus usque nigra; tectricibus alarum superioribus minimis luteis; rectricibus albo et nigro variis."

"Habitat in Mexico." Brisson, as above.

Probably not a bird of this family. Brisson seems to abridge from "Eus. Nieremb. pag. 209," which author is not included in my circle of antique acquaintances.

4. *RAMPHASTOS GLAUCUS*, Müll. Syst. Nat. Supp. p. 84 (1776).

Ramphastos caeruleus, Gm. Syst. Nat. i. p. 357 (1788).

Tucana caerulea, Briss. Orn. iv. p. 433.

"*Tucana in toto corpore coeruleo et cinereo varia*."

"Habitat in Mexico." Brisson, as above.

This is another of the descriptions which Brisson apparently copies from "Eus. Nieremb. pag. 209," and perhaps also somewhat from "Aldrovandus, Orn. l. p. 803, in qua hujus icon a Nierembergio mutuata." The figure in Aldrovandus probably is intended to represent a bird of this family, but neither it nor his description applies to any known species.

5. *RAMPHASTOS DUBIUS*, Gm. Syst. Nat. i. p. 357 (1788).

Blue-throated Toucan, Lath. Syn. i. p. 357.

"In a list of birds in the Museum of *Baron de Fauquier de Montpellier*, I find one by the name of *Toucan à gorge bleue*, with this addition, 'Ce Toucan n'est décrit par aucun auteur.' I do not find a Toucan with a blue throat mentioned by any writer, and must therefore, with him, conclude it to be a new species. As it is but very lately that I have known this circumstance, it has not been in my power to say further on this head, resting the whole, for the present, on his opinion." Latham, as above, and in Gen. Hist. ii. p. 294, gives the same account of it, in substance. I agree in allowing it to rest for the present, but should the original Baron or other be disposed to stir in the matter he can now be better accommodated.

6. *RAMPHASTOS BYRON*, Müll. Syst. Nat. Supp. p. 82 (1776).

Buceros albus, Gm. Syst. Nat. i. p. 361.

"Captus inter insulas Tinian et Pulotimeon, anseris magnitudine."

A white Toucan, the size of a Goose! I guess not.

7. *RAMPHASTOS INDICUS*, Miller, *Cimelia Physica* p. 102 (1796).

Mill. Cym. Phys. pl. 57.

"*Ramphastos gula remigibus caudaque nigris, genis pectoreque albis, abdomine femorisque luteis, vertice rubro-aurantio, uropygio phœniceo*." Miller, as above.

Usually cited doubtfully as a synonyme for *R. Toco*, but the plate represents no species at present known, and has the appearance of having been drawn from a made-up or fictitious specimen, the head rather especially.

[Sept.

October 1st.

The President, DR. HAYS, in the Chair.

Twenty-three members present.

Dr. Leidy exhibited specimens of black hornstone, a variety of basanite, from the limestone of Easton, Pa., and observed that he had suspected it was of organic origin. Low microscopic power exhibits in this hornstone a composition resembling oolite.

October 8th.

MR. VAUX, Vice-President, in the Chair.

Twenty-four members present.

October 15th.

The President, DR. HAYS, in the Chair.

Thirty-five members present.

The following was presented for publication :

"Notes on a Collection of Mammals from Arizona." By Elliott Coues, M. D., U. S. A.

Prof. Holmes, of Charleston, exhibited specimens of remains of extinct and recent animals, accompanied by bones of man, together with pottery, stone arrow-heads and hatchets, which he observed were obtained from the post-pliocene strata in the neighborhood of Charleston.

Dr. Wood made some remarks on a fresh-water alga from the thermal springs in Mono Co., Cal., which was said to grow in water having a temperature of from 120°—136° F.

October 22d.

The President, DR. HAYS, in the Chair.

Twenty-three members present.

The following papers were presented for publication :

"Notes on a Collection of Californian Myriapoda, with the description of a new Lithobiid from Illinois." By Horatio C. Wood, Jr., M. D.

"Note on Geotrygon sylvatica, Gosse." By Richard Hill.

Abstract of a verbal communication to the Academy of Natural Sciences of Philadelphia, 22d Oct., 1867, by Benj. Smith Lyman.

On the Great CARBONIFEROUS CONGLOMERATE in Sullivan County, Pa.

It has been hitherto supposed that the Great Conglomerate, or Formation No. XII, at the bottom of the coal measures, thinned away so rapidly northward from a thickness of twelve hundred feet near Mauch Chunk, that it had a thickness of only a hundred feet on the northern edge of the Wyoming Valley, and still less in the First Bituminous Coal Basin north-west of that. A recent examination of exposures in the First Bituminous Coal Basin, on the Berwick and Towanda Turnpike, in the eastern part of Sullivan County, some thirty miles north-west of Wilkesbarre, and twenty-five from the nearest anthracite 1867.]

coal, shows that the Great Conglomerate is really something like four hundred feet thick. It consists here of two beds of pebble rock with white quartz pebbles of the size of chestnuts, each bed perhaps seventy or a hundred feet thick, and of some two hundred feet or more of sand rocks between, that are light brown at the bottom and greenish above, and thin-layered throughout, and resembles closely the sand rocks of the productive coal measures. Some sixty feet from the bottom of the sand rocks is a bed of shaly red iron ore, three or four feet thick, with a six inch layer of rich dark carbonate of iron nine inches above the red ore. Immediately below the lower bed of pebble rock there is more red iron ore and the red shales of No. XI.

At Shinersville, a mile and a half north of the Birch Creek Coal Mines, the top of the lower pebble rock is seen dipping southerly towards that creek quite steeply for that region, say fifteen degrees; and, according to the State Geological Report, the red shales of No. XI. are seen underlying this pebble rock a short distance further north. Even if this dip should grow gentler, as it no doubt does, on approaching the bottom of the basin near Birch Creek, yet this lower puddingstone must pass far below the coal. On the hillside from Shinersville down to Birch Creek no rocks are to be seen in place in the road, but it is plain that the pebble rock is not immediately under the soil, and the ground has upon it a great many blocks of brownish sandstone. On the south side of Birch Creek, near the foot of the hill, two small ledges of this sand rock crop out in the road apparently in place, and apparently below the upper pebble rock. At the Birch Creek Mines the dip is very gentle, northerly. On the hill side just north of the Loyalsock Creek, (which the turnpike crosses at three miles from Shinersville) the outcrop of the upper pebble rock is very conspicuous, but it does not reach to the bottom of the hill. Below it are large blocks of thin-layered light brown sand rock, but none probably quite in place. No red shales seem to be visible now on the turnpike near the Loyalsock on either side, in spite of an allusion in the State Report to such an exposure; nor is the lower pebble rock exposed here; but, according to the State Report, a pebble rock, which must be the lower one, is exposed in the bed of that stream some miles below the crossing of the turnpike. On the south side of the Loyalsock the sand rock is well exposed in the road in many ledges; it is all thin-layered, a little shaly, brownish below and greenish near the top of the hill; and the dip is gentle, northerly. South of the first summit south of the Loyalsock is a slight hollow with ledges of the same sand rock with the same dip on the northern side, and on the top of the next summit to the south bits of red iron ore are exposed in the road with a quantity of blue shaly sandstone lying near it. On the south side of this second summit from the Loyalsock there is plainly an outcrop of the lower pebble rock. The ground rises gently, with some small hollows here and there for half a mile from the last mentioned summit, and there is exposed a broad flat ledge of pebble rock with a decided but gentle northerly dip (perhaps three degrees) plainly passing under the sand rocks to the north. The whole thickness here of these sand-rocks would seem, at a guess, to be some 200 or 250 feet. Still further south on the turnpike, after passing over the rough outcrop of the lower pebble rock with low cliffs and huge blocks on the north side of Lopus Creek, with a dip of perhaps ten degrees, and again north of Painter Den Run, with a gentle northerly dip, the red shales of XI with iron ore at the top, are clearly exposed to a thickness of perhaps fifty feet on the south side of Spring Brook, about eight miles south of Shinersville; and this brook cuts down even deeper, into a greenish gray sand rock. The lower pebble rock crops out for a mile or so south of these red shales as far as the hill side south of Bear Swamp Run, and lies in great blocks, with here and there a small ledge in place in the road which shows apparently a very gentle southerly dip. South of this appear the sand rocks of Long Pond, that continue along the turnpike for three miles with little or no dip in any direction but much cross-bedded. They are

[Oct.

followed for a mile on the south by the lower pebble rock, which is followed at the brow of the North (or Alleghany) Mountain by the red shales of XI, and these below by a greenish gray sand rock. The sand rocks of Long Pond amount to a thickness of about 190 feet, according to a rough leveling from an exposure of the lower pebble rock, three quarters of a mile south-east of the Pond, to the top of a hill a quarter of a mile north-east of the Pond. The upper seventy feet of these sand rocks are, at least in part, greenish in color, the lower 120 feet are mostly light brown or sometimes white. The iron ore has been proved by digging and boring about sixty feet above the lower pebble rock, and it has about fifteen feet of blue shaly sand rock below it, that grows black towards the bottom, and seems to have true coal slate below it in some places and very dark sand rock for a few feet below that. The lower pebble rock here seems to be some seventy feet thick; some of its layers turn into sand rock in parts; and some thirty feet below the top is an irregular bed of coal slate that varies from nothing up to perhaps eighteen inches in thickness and has sometimes a few inches of coal.

The apparent correspondence of this coal with a thin coal bed within the upper pebble rock, at Birch Creek, and the discovery of the coal slate near the iron ore, and the general close resemblance of the sand rocks to those of the productive coal measures, together with the statements in the State Report of the thickness of the Great Conglomerate in this region, led very naturally to the belief that the pebble rock at Long Pond was the same as the one at Birch Creek, that it was, in fact, the whole of No. XII, and that the sand rocks of Long Pond were those of the productive coal measures, and contained, like those of Birch Creek, a five foot coal bed near the bottom, and a thirteen foot one some fifty-five feet higher up. The lower 150 feet of the Long Pond sand rocks have been, however, pretty thoroughly proved by borings and other exposures to contain no coal bed.

October 29th.

MR. CASSIN, Vice-President, in the Chair.

Seventeen members present.

Chas. W. Matthews was elected a member.

On favorable reports of the Committees, the following papers were ordered to be published:

Notes on a Collection of California MYRIAPODA, with the Descriptions of New Eastern Species.

BY HORATIO C. WOOD, JR., M. D.

The California specimens, herein noted, were collected by my friends, Dr. George H. Horn, late Surgeon United States Volunteers, and Mr. William M. Gabb, of the State Geological Survey, who generously gave them to me. It will be noticed that certain species, which were assigned in my monograph to Georgia, are included in the collection. Yet I do not believe that the geographical range of these species is by any means so extensive. All the specimens alluded to as described formerly as natives of Georgia, were collected by Dr. Le Conte. That gentleman informed me, whilst preparing my extended memoir, that he had made collections both in Georgia and California, and presented them to the Academy of Natural Sciences. There was but a single bottle to be found in the cabinet with the doctor's name attached, and that was labelled Georgia; consequently I concluded that the California specimens were missing. There can be no mistake as to the localities assigned to the various species in the present paper, and it seems most probable that Dr. Le Conte's specimens of Californian myriapods were emptied by some 1867.]

one into the bottle containing the Georgian species, and that such as are herein noted are strictly Californian types.

Gen. MECISTOCEPHALUS.

M. QUADRATUS, n. sp.

M. saturate aurantiacus, venuste politus; capite sparse distincte punctato; antennis sparse pilosis; labio distincte punctato, medio sulcato; mandibulis distincte punctatis, intus denticulis parvis duobus armatis; suturis sterno-episternalibus et scuto-episcutalibus conspicuis; scuto postremo triangulare; pedibus utrinque 51.

The head is rather large. The cephalic segment is slightly narrowed from near the front posteriorly. The punctations, both on the upper and under surface of the head, are mostly arranged in longitudinal series; they are much more numerous on the under surface; there is a transverse row of them on the anterior border of the cephalic segment. The mandibles are furnished, on their inner margin, with two minute distant denticules; upon the labium at their base is a minute black dot. The scuto-episcutal sutures are very distinct, and communicate at their bases so as to leave a central quadrate islet.

Length, about an inch and a half.

Hab.—Los Gatos, Coast Mountains.

Gen. GEOPHILUS.

G. LÆVIS, Wood.

Three specimens from the Santa Cruz Mountains, agreeing in all important characters with Dr. Le Conte's specimens supposed to have been collected in Georgia. The only difference is that there is not, in any of them, a ventral median line; some of them have central sternal indentations, which may be considered rudiments of such a line.

Gen. BOTHROPOLYS.

B. XANTI, Wood.

Specimens from San Jose, California, and Santa Cruz Mountains, agreeing well with published description.

Gen. SCOLOPOCRYPTOPS.

S. SPINICAUDA, Wood.

Specimens from San Jose, agreeing with published description, except that the head is scarcely profoundly punctate, and the scuta not rugous; from Los Gatos Mountains, agreeing well.

Gen. STRIGAMIA.

S. LÆVIPES, Wood.

Specimens from Santa Cruz Mountains and Los Gatos, Coast Mountains, which exhibit no specific differences from the specimens said to have been collected in Georgia by Dr. Le Conte.

S. GRACILIS, sp. nov.

S. saturate olivacea, gracilis, elongata; capite sparse punctato; segmento cephalico elongato; antennis modice longis; labio sparse punctato, medio leviter canaliculato; mandibulis parvis, intus denticulo parvo armatis; scutis nonnihil rugosis; sternis suturis sterno-episternalibus et depressione mediana instructis; pedibus utrinque 96, modice longis.

The body of this geophilid is very long and slender. The head and mandibles are sparsely pilose. The color is dirty olive, approaching a slate; the antennæ are more of an orange. The mandibles are furnished on their inner margin with a single small tooth. The scuta have frequently a somewhat obsolete central depression; they do not have the sutures well marked, but are more or less irregularly wrinkled. The last pair of feet in the single specimen I have seen are large and massive; their coxal joint is not pitted.

Hab.—San Jose.

[Oct.

S. INERMIS, sp. nov.

S. aurantiaca; corpore valde depresso, antico modice angustato; capite modice magno; segmento cephalico triangulare, modice lato; antennis brevibus, submoniliformibus, haud acuminatis; mandibulis parvis, haud denticulatis sternis depressione mediana instructis; pedibus crassis, brevibus, utrinque 115; scutis brevibus sine suturis.

The labium is strongly narrowed posteriorly by the very large basal joint of the mandible encroaching on it. In general appearance this species closely resembles *G. teniopsis*, Wood, from which it is separated by the wide disparity of the number of joints. The coxæ of last pair of feet are not pitted.

Hab.—Santa Cruz Mountains, California.

Gen. POLYDESMUS.

P. HAYDENIANUS, Wood.

Specimens from the Santa Cruz Mountains, agreeing well with the published description.

P. DISSECTUS, sp. nov.

P. olivaceus?; scuto anale parvo, triangulare; appendicibus masculis maximis; spina terminale magna, robusta, intra pilosa, ultima in spinulis 4 secta.

The specimens which I have seen have either lost their color from long contact with alcohol, or else are individuals which have recently shed their skins. The pattern of coloration is therefore not to be made out with certainty. The lateral laminae evidently differ in color from the remainder of the scutum. The male genital appendages are large. They are robust and very hairy. The terminal spines are robust, and so placed at right angles to the rest of the part as to be nearly horizontal and anteriorly divergent. They are furnished on their inner surface with numerous long rigid hairs. Each spine in its distal third is divided into two parts, and the upper of these (the one nearest the body) consists of a short, robust, curved process, which is opposed to the lower part much as the thumb is to the fingers. The lower division is much the larger, and is terminated by a short, inconspicuous, blunt process and three spines; of the latter, the lowermost is broad, thin, obtuse, and as it were twisted on itself; the other two are sub-cylindrical, acute and simply curved, the larger of them is slightly sabre-shaped.

This species belongs in the group *Fontaria*.

Hab.—Fort Tejon.

Gen. SPIROBOLUS.

S. UNCIGERUS, Wood.

A number of specimens, agreeing well with the published description, excepting that they are much darker in color.

Hab.—San Jose, Fort Tejon.

Gen. JULUS.

J. OREGONENSIS, Wood.

Hab.—Fort Tejon, San Jose.

Gen. CRYPTOPS.

C. ASPERIPES, sp. nov.

C. aurantiacus; antennis 19 articulatis; pedibus postremis dilute aurantiacis, modice robustis, longissimis, spinulis acutis nigris numerosissimis armatis; appendicibus analibus lateralibus truncatis, profunde punctatis, spinulis paucis instructis.

Long., unc I.

The color of this strange little animal is orange, mostly somewhat deeper on the head and lighter on the feet. The labium is convex, rather short, and edentate. The mandibles very long. The cephalic segment has a dark, more or less concentric marking. The scuto-episcutal sutures are well marked, and there is in many specimens a central line. The antennæ have 19 joints each,

1867.]

and the latter are so short and broad that they are almost moniliform. The hindmost two or three pairs of feet are roughened by small black acute spines, which are especially pronounced on their femora and tibiæ. The last pair are very much longer than any of the others and, when preserved in alcohol, the last three joints are bent into the form of a triangle, so that the terminal claw rests on the tibiæ-tarsal articulation, pointing inwards; the femora and tibiæ are almost covered with the very numerous black spines. In most specimens there is a sharp black spinule on the upper posterior angle of the lateral anal appendages. I am indebted to Prof. Leidy for my specimens of this species. He caught them in the woods on the Alleghanies of Montgomery County, Virginia.

Gen. LITHOBIUS.

L. BILABIATUS, sp. nov.

L. brunneus; segmento cephalico sparse leviter punctato, late subcordato, margine postico elevato; antennis modice longis, nonnihil pubescentibus; ocellis utrinque 13; labio antice producto, sine lamineis dentalibus distinctis, cum lateribus sejunctis usque ad basem; dentibus sejunctis 4—6; scutorum marginibus posticis rectis, angulis haud productis; pedum pare postremo in mare magno, processibus magnis duobus utrinque armato.

The general color of this species is a dark brown, with the labium and feet lighter, somewhat approaching ferruginous. In the male the last segment with its appendages is much lighter than the rest of the body. The cephalic segment is very broad in the male, much broader than the anterior portion of the body. The labium is produced forward in such a way that there are no distinct dental laminæ. The two halves are separated or merely joined by a membrane almost to their base. Anteriorly they are very close to one another, but then separate so as to make an elliptical opening closed by a thin membrane and a little ligula-like process projecting on the superior portion. The styliform appendages of the anal segment appear to be wanting in the male. The margins of the scuta are remarkably straight, the angles generally rounded, so that they are not all emarginate. The feet generally are robust and somewhat compressed. In the male the hindmost ones are very large, the coxæ short, the thigh short with the distal internal angle prolonged into a well-pronounced process surmounted by numerous spines; the next joint is large, with a long, robust, curved process projecting inwards from its proximal third, and also a small, nearly cylindrical one on its distal inner angle.

In the female the next to last pair of feet is larger than those anterior to it; the last pair long, cylindrical, still larger, without processes, but with numerous spines on the enlarged distal end of the thigh. I am indebted to the well-known entomologist, Mr. Walsh, of Rock Island, Illinois, for a male and female of this species, by whom they were captured in the vicinity of his home.

Length, $\frac{3}{4}$ an inch.

Note on *GEOTRYGON SYLVATICA*, Gosse.

BY RICHARD HILL.

(Communicated by Thomas Bland, New York.)

Spanish Town, Jamaica, 7th June, 1867.

TO THOMAS BLAND, ESQ.:

My Dear Sir:—In examining, the other day, our large ground dove, found only in solitary places in our mountain forests, (the bird familiar to you by the name of the mountain witch, but so named less from the beauty of its coloring than from its mysterious movements—moaning in the underwood,) it struck me that, in habits and contour, it had an apparent relation to the extinct *Dodo*, the *Didus ineptus* of naturalists. A careful examination of the only remains of the *Dodo*,—the head and foot in the British Museum,—establishes

[Oct.

that it was one of the Columbidae. Our mountain ground dove is the *Geotrygon sylvatica* of Gosse. Its habits are solitary; it is of a thick, heavy form; seldom seen on the wing; feeds on the ground, and has a moaning coo.

The *Geotrygon sylvatica* varies in plumage from light bright tints to a sombre blending of bronze and claret-purple. It is drab colored on the head, varying from blue to dull yellow. The feathers fall into a kind of hood, and the plumage of the breast to the legs is edged so as to appear scaled. A scaled feathering prevails in all the under plumage. It resembles in this peculiarity the *Carpophaga* of Eastern Australia; a style of feathering rare in doves, but characterizing the Dodo. Our bird is such a lover of solitude that it is seldom seen; few know its habits, beyond the lonely moaning and the uncertain movements that render the tracing of it difficult in the forest.

Our bird is the largest of our doves; as big as a pullet. The bill has considerable curvature and fleshiness, large and strong. It would be easy, by studied exaggeration of the rounded heavy contour, with the pigeon beak, and the dumpy goose-shape, to make out the Dodo-form, between the figures of Bontius and Leguat. We have only to elevate it into its habitual stride, and we have the stateliness and grace in Leguat's description of the solitary bird of the Island of Rodrigo. That description is just our mountain-witch, grown to the size of a turkey.

Our bird is noticeable for its rasorial scratching, if that habit be correctly reported. It is said to take in occasionally such molluscous food as the snail, with the eggs of termites. Mr. Gosse's information relative to mollusks is very precise. He detected the snail among the contents of its craw. This is a great deviation from the pigeon character. Pigeon food only varies from grain by the occasional mixture of the young shoots of such succulent herbage as turnip tops.

Sir Hans Sloane has in his manuscript notes an observation made by L'Es-trange on the living Dodo. It is introduced as an annotation by Wilkins in Pickering's edition of Sir Thomas Brown's "Vulgar Errors." "About 1638 as I walked London streets I saw the picture of a strange fowle hong out upon a cloth, ———vas* and myselfe with one or two more Gent, in company went in to see it. It was kept in a chamber, and was a great fowle somewhat bigger than the largest Turkey Cock and so legged and footed, but stouter and thicker, and of a more erect shape, coloured before like the breast of a young cock Fisan (pheasant) and on the back of dunn or deare colour. The keeper called it a Dodo and in the ende of a chimney in the chamber there lay a heape of large pebblestones whereof hee gave it many in our sight, some as big as nutmegs."

Yours, &c.,

RICHARD HILL.

November 5th.

The President, DR. HAYS, in the Chair.

Thirty-two members present.

Prof. E. D. Cope presented to the Academy specimens of four extinct species of Mammalia, which were discovered by Jas. T. Thomas, in the Miocene deposits of the Yorktown epoch in Charles Co., Maryland.

The first was a species of the genus *Eschrichtius*, to which the recent hump-back whale is allied, of a species not previously known. It was called *E. CEPHALUS* Cope. The remains preserved were a considerable portion of the muzzle, both rami of the mandible, several vertebrae, and a considerable number of pieces of the hand, with ulna, humerus, etc. Other specimens, previously presented to the Academy, probably belonging to the same species, were some cervical and dorsal vertebrae, portions of cranium and os petrosium

* The name is in part erased, perhaps it was *Gervas*, for *Gervas Hollis*, the antiquary. 1867.]

from Yorktown, Va., and os petrosus from Tarboro', N. Ca. The mandibular rami measured 9 ft. 4 in. and were referred to an individual 31 ft. long. They were compressed, and with a narrow superior ridge, without nutritive foramina. The hitherto known Miocene Whales—*Balaena prisca* and *B. palaeatlantica* of Leidy—founded on portions of the mandibular rami, were much less compressed, were furnished with numerous marginal nutritive foramina, and the *B. prisca* was without superior ridge. The anterior cervical vertebrae were transverse quadrate. The arms were much shorter relatively than the recent *M. longimana* and *M. osphya* of the American coast. Mandible with a low coronoid process.

The second, named *RHABDOSTEUS LATIRADIX* Cope, was a peculiar genus near the Delphinidae, allied to *Priscodelphinus* Leidy, and perhaps *Platanista* of the Ganges. Characteristic of it was a muzzle formed of the usual elements but entirely cylindrical, the alveolar series approximated underneath, and ceasing near the middle. Beyond this the muzzle was prolonged like a cylindrical beak of a sword fish, or *Coelorhynchus*, and probably much farther than the mandible. Alveolæ longitudinal fragmentary specimens of this muzzle had been found by the discoverer 2-5 feet in length.

Thirdly, a fragment of the muzzle, including the proximal portions of the maxillary bones, with molars, and the canine teeth of the *SQUALODON ATLANTICUS* (Leidy). As the Miocene representative of the larger species of the Eocene period, it was shown to possess a close affinity to the Miocene *Squalodon grateloupianus* (Gerv.) of Malta and France. The double serration of the molars and their deeply divided compressed fangs were features in which it differed from its congener.

SQUALODON MENTO Cope was characterized from four molar teeth, which were between two and three times as large as those belonging to the *Squalodon wymanianus* (*Phoca* of Leidy) with similar short incurved crowns, but much more rugose. One molar had a smooth compressed fang, which was little curved and with groove on each side. The fangs of the others were weathered, not grooved, curved and acute.

November 12th.

The President, DR. HAYS, in the Chair.

Thirty-two members present.

The following was presented for publication :

An addition to the Vertebrate Fauna of the Miocene Period of the United States. By Edward D. Cope.

The death of Prof. Michael Faraday, correspondent, was announced.

Dr. Le Conte made remarks, illustrated by specimens, upon the tertiary coal-beds of New Mexico, in the vicinity of the Rocky Mountains, and upon the cretaceous coal-beds of the Rio Grande Valley. Both regions were regarded by him as capable of supplying abundant fuel for railroads, metallurgic and manufacturing purposes. He also mentioned beds of lignite coal, in the vicinity of Denver, of great thickness—from 11 to 16 feet—free from impurities.

November 19th.

The President, DR. HAYS, in the Chair.

Thirty-four members present.

[Nov.

November 26th.

The President, DR. HAYS, in the Chair.

Thirty-three members present.

The following gentlemen were elected Correspondents :

Mr. W. S. Bingham, of Boston ; Prof. O. Root, of Utica, N. Y., and Col. E. Jewett, of Utica, N. Y.

The following were elected Members :

Messrs. Edw. R. Murphy, Lloyd P. Smith, F. A. Hassler, G. Y. Shoemaker and Matthew Newkirk.

On favorable report of the Committee, the following paper was ordered to be published :

Notes on a Collection of **MAMMALS** from Arizona.

BY ELLIOTT COUES, M. D., U. S. A.

Circumstances have unavoidably delayed, until now, the preparation of the present article, needed to complete the record of the zoological collections made by the writer in Arizona during 1864 and 1865. Articles upon the Coleoptera, by Dr. J. L. Le Conte ; upon the Batrachia and Reptilia, by Prof. E. D. Cope ; upon the Cheiroptera, by Dr. H. Allen ; and upon the Birds, by the present writer, have already appeared in these Proceedings. The few fishes collected were unfortunately destroyed in transitu. The plants, collected jointly by Dr. E. Palmer and the writer, still remain in the hands of Dr. Geo. Engelmann, of St. Louis, to whom they were transmitted for examination and identification. These collections, taken together, may be considered to represent, in a measure, the more prominent features of the fauna and flora of the Territory.

The classification and nomenclature here adopted is that of Prof. Baird's "Mammals of North America" (Pacific Railroad Report, vol. viii.) A general sketch of the Quadrupeds of Arizona, by the present writer, has already appeared in the "American Naturalist," vol. i., Nos. 6, 7, 8 and 10.

CHEIROPTERA.

VESPERTILIONIDÆ.

1. **VESPERTILIO SUBULATUS**, Say.

Several specimens. An abundant and generally distributed species.

2. **VESPERTILIO MACROPUS**, n. s., Allen, Pr. A. N. S., Phila., Aug., 1866, p. 288.

One specimen, Colorado Desert, near Fort Mojave ; taken in broad daylight, as it was capturing insects over a small pool.

3. **ANTROZOUS PALLIDUS** (Le Conte), Allen.

Several specimens. An abundant species in the Colorado Valley and southern portions of the Territory ; particularly numerous at Fort Yuma.

Other species of this family, found in Arizona, according to Dr. Allen, are : *Lasiurus cinereus*, *Vespertilio lucifugus*, *V. evotis*, *V. nitidus*, and *Corynorhinus macrotis*.

CARNIVORA.

FELIDÆ.

4. **FELIS CONCOLOR**, Linn.

One specimen, a fine hunters' skin, measuring 6½ feet from tip to tip. This animal is generally distributed, but of rather unfrequent occurrence.

1867.]

5. *LYNX RUFUS*, Rafinesque, var. *maculatus*.

Several specimens. Of frequent occurrence, particularly in the vicinity of Fort Whipple.

*CANIDÆ.*6. *CANIS LATRANS*, Say. (*C. frustror*, Woodhouse.)

Numerous specimens. The most abundant of the larger mammals of the Territory, and very generally distributed. It is particularly numerous in the vicinity of the settlements, and very annoying. Numbers may be readily destroyed by poison, as is frequently done. The pelage in winter is fuller and softer than in summer, and chiefly black and grayish-white, losing the tawny and rufous which it has in the latter season. Reproduction occurs in May or June, five or six young being ordinarily brought forth, in rocky, secluded places. The species is frequently precluded from indulging its carnivorous tastes, and compelled to subsist, in great measure, upon fruits and berries.

7. *CANIS OCCIDENTALIS*, Rich., var. *griseo-albus*.

Several specimens, taken at Fort Whipple in winter, are referrible to this variety. The skins make very beautiful robes. No black or tawny individuals were observed. The species is generally distributed over the Territory, though by no means so abundant as the preceding.

8. *VULPES VIRGINIANUS*, Richardson.

Three examples. The species is of common occurrence. No red foxes were met with. *V. macrourus* and *V. velox* may possibly be found in the Territory.

*URSIDÆ.*9. *URSUS HORRIBILIS*, Ord.

One specimen, a quarter-grown cub, killed with its dam in the San Francisco Mountains. The species is of common occurrence in that locality.

RODENTIA.

*SCIURIDÆ.*10. *SCIURUS ABERTHI*, Woodhouse.

S. dorsalis, Woodhouse. (Pre-occupied.)

S. castanonotus, Baird. (Without ear-tufts.)

Three specimens, San Francisco Mountains. A large and very beautiful species, abundant, and a characteristic of the pine-covered mountainous portions of the Territory.

11. *SCIURUS ARIZONENSIS*, n. s., Coues, Am. Naturalist, i., 1867, p. 357.

One specimen, Fort Whipple, Dec. 20, 1865; type of the species as described l. c. No other examples met with. A gray squirrel, resembling the common Eastern species, but smaller, the tail longer and broader, and distinctly tricolor below.

In addition to the two preceding species *S. Fremontii*, Aud. and Bach., is believed to occur; and *S. fessor*, Peale, from California, may possibly reach the Colorado Valley.

12. *TAMIAS DORSALIS*, Baird.

Numerous examples. An abundant species throughout the Territory. Closely allied to, but readily distinguishable from the other recognized species. It lives chiefly, or wholly, in rocky, broken localities.

13. *SPERMOPHILUS BEECHYEI*, Cuvier.

Two examples. This species ranges into Arizona from California, but is there by no means so abundant as in the last mentioned region, where, in a measure, it represents the prairie dog of the plains, both in numbers and in habits, and proves a great pest to the farmers.

[Nov.

Other Arizonian *Spermophili* are: *S. grammurus*, Say, in the southern portions; *S. tereticauda*, Baird, in the lower Colorado Valley; *S. Harrisii*, Aud. and Bach.; and probably also *S. lateralis*, *spilosoma*, *Mexicana*.

14. *CYNOMYS GUNNISONII*, Baird.

One specimen, taken near the San Francisco Mountains, July, 1864. This rare species was there found living in colonies like those of *C. ludovicianus*, only of smaller extent. The general habits of the two appeared very similar.

15. *CASTOR CANADENSIS*, Kuhl.

Although no specimens of this animal were actually collected, it was frequently seen, and is included here for the purpose of remarking upon its great abundance on nearly all the streams of the interior of the Territory. Its present numbers are doubtless owing to the fact that, of late years, it has been but little, if at all, molested by trappers, whom Indian hostilities have prevented from penetrating to its haunts.

SACCOMYIDÆ.

16. *THOMOMYS FULVUS* (Woodh.) Baird.

Two specimens, Fort Whipple. The most abundant and characteristic species of the subfamily Geomyinæ, and generally distributed over northern and central Arizona. It is almost wholly subterranean and nocturnal in habit. The small piles of soft, moist earth, seen all over the fertile grassy portions of the Territory, are thrown up by this animal in digging or extending its burrows; and are particularly numerous in the vicinity of clumps of oak. Two other species, *T. bulbivorus* and *T. umbrinus* probably occur in southern and western Arizona.

17. *DIPodomys ORDII*, Woodhouse.

Numerous specimens of this very abundant animal, the "kangaroo rat" of the inhabitants; from Fort Whipple and vicinity. This species seems susceptible of a semi-domestication, like the true *Mures*; and, together with a species of *Hesperomys*, is very common in the storehouses and granaries of Prescott and Fort Whipple, where they readily produce their young. Ordinarily it lives in brush heaps, under fallen logs, etc., as well as under ground. The young are brought forth in May and June; but two or more litters may be produced, especially when the animals are living in places protected from the weather. The young are at first nearly gray, showing little of the clear fawn of the adults. The ordinary mode of progression with these animals is the same as that of other small rodents; but the movements upon all-fours are changed to a series of vigorous leaps when the animals are alarmed.

18. *PEROGNATHUS FLAVUS*, Baird.

One specimen (Fort Whipple) of this rare and diminutive rodent. Two other species, *P. parvus* and *P. penicillatus*, also occur.

MURIDÆ.

MURINÆ. (Sigmodontes.)

19. *HESPEROMYS EREMICUS*, Baird.

Numerous specimens, both old and young, determined to be this species by Prof. Baird. It is the characteristic species of the vicinity of Fort Whipple, where it is semi-domesticated, and, in a measure, plays the part of the house mouse, living and breeding in numbers in buildings. Several other closely allied species of this difficult genus probably also occur, as well as one or two of the genus *Reithrodon*.

20. *NEOTOMA MEXICANA*, Baird.

Several examples. A very common species throughout the Territory, living indifferently under ground or rocks, in brush heaps, or in low scrubby trees. It is an important article of food with the Indians.

1867.]

Among the true *Mures*, or "Old World rats," two species have been imported into the settlements along the Colorado River, *Mus decumanus* and *M. musculus*. Apparently, however, they have as yet hardly penetrated to the interior of the Territory.

ARVICOLINÆ.

21. ARVICOLA ——— ?

Fragments of an undetermined species, taken from the stomach of a large hawk, shot at Whipple. The genus appears to be very poorly represented in the number of its individuals as well as of its species.

22. FIBER ZIBETHICUS, Cuvier.

Skins, sewn together to make arrow-cases, taken from the Apaché Indians. The species seems to be common on some of the waters of the Territory.

LEPORIDÆ.

23. LEPUS CALLOTIS, Wagler.

Three specimens, Fort Whipple. The "jackass rabbit," as the species is called, is very abundant throughout the Territory. Believed to be the only large hare ascertained to inhabit the Territory, though the occurrence of one or two other species, particularly *L. Californicus*, may be anticipated.

24. LEPUS ARTEMISIA, Bachman.

One specimen, Beall's Springs, Western Arizona. A very abundant species throughout the Territory. In the northern portions, at least, it changes its pelage somewhat in winter, losing in great measure the tawny or fulvous, and becoming of a grayish hue, with some parts nearly white. Such a change has not been observed to take place with *L. callotis*.

25. ERETHIZON EPIXANTHUS, Brandt.

One specimen, from the Colorado Chiquito, a locality where the species seems to be particularly abundant.

RUMINANTIA.

CERVIDÆ.

26. CERVUS MACROTIS, Say.

One skin of a doe, taken in October, when the summer coat has been replaced by that of winter. The latter is thicker and fuller, and of a much more uniform mouse-gray. At this season the antlers of the males are well-grown. They differ in some essential points from those of *C. virginianus*. These deer inhabit the open woods and chapparal. A second species, known to hunters as the "white-tailed deer," occurs, but rarely. The black-tailed still continues to be very abundant in all situations suited to its habits; and its flesh and hide are important items in the domestic economy of both settlers and Indians.

27. ANTILOCAPRA AMERICANA, Ord.

Several pairs of horns, and skins of the head, stuffed by the Indians to be used as decoys. Both the present species and the black-tailed deer are hunted by the Indians by this means. One pair of horns, taken near Fort Whipple, are remarkable for the great breadth of the prong, which springs from the extreme base of the shaft, and for the unusual degree of apical curvature of the latter; the tip being bent over until it points directly toward the base of the horn, and its axis is brought quite parallel with that of the upright portion. The antelope is still common on all the open plains of the central and northern portions.

28. OVIS MONTANA, Cuvier.

Horns of this species were often met with about the bases of cliffs and precipices. The animal appears to be much less abundant now than formerly, and only inhabits the most rugged and inaccessible mountainous regions.

The buffalo (*Bos americanus*), which formerly inhabited the Territory, has for many years been quite extinct.

[Nov.]

December 3d.

The President, DR. HAYS, in the Chair.

Thirty-five members present.

Dr. H. Allen exhibited ten crania from the Morton collection, in which was seen the tertiary occipital condyle. This was situated in each instance upon the anterior border of the foramen magnum, was elevated, and more or less circular. It was thought the "condyle" (i. e. facet) was the result of the odontoid process of the axis extending higher, as well as the basilar process being thicker than usual. These conclusions were born out by the examination of a number of axes, in position, as well as disarticulated. In the former it was seen that the superior fasciculus of the transverse ligament often brought the apex of the process in relation to the occipital bone, even when no facet was formed; in the latter several specimens of the isolated bone had been secured, showing two distinct facets upon the odontoid process—the inferior one for the articulation with the atlas,—the superior for the "tertiary condyle."

The following are the measurements of the most conspicuous facets :

996. The facet is 13 m. wide, 8 long, with irregular but well defined borders; the anterior wall is 4 m. high; asymmetrical,—the greatest portion to the left side of the median line. The right border is furnished with anodule at its posterior part. The superior surface of the basilar process is furnished with a small spicule of bone.

631. Facet 11 m. wide, 7 m. long, slightly depressed, a little fuller upon the right than left side; asymmetrical, the greater portion to the right side of median line. The condyles are large with transverse constriction.

1436. 8 m. wide, 8 long, slightly depressed. The left side has appended to its posterior part a sharply defined horn, which is curved forwards upon itself; asymmetrical—almost entirely to right side of median line. Upon either side of facet and immediately in front of the occipital condyle are placed two rounded nodules, the right of which is the larger. Condyle not constricted.

1460. 13 m. wide, 9 long, sides regular, anterior portion slightly elevated; a large spicula, 5 m. long, extending from superior portion of basilar process downwards; facet placed a little to the right side.

93. 5 m. wide, 3 m. long—not depressed—walls not elevated, yet the whole facet stands slightly above the level of the bone placed in median line. The occipital condyles are of unequal size. The left is 24 m. long and 14 m. wide at largest diameter. The right is 30 m. long, 14 wide at largest diameter, while the anterior portion is much more slender than that of the opposite side, running in advance of the facet; facet in median line.

569. The posterior part of the basi-occipital process 6 m. thick, has towards its inferior surface a small circular depression measuring 5 m. \times 5 m., defined by a sharp edge which is better marked in front than elsewhere. The entire facet is to the left of the median line and entirely free from the posterior border. A smaller depression, having a diameter of $2\frac{1}{2}$ m., is placed upon the right side upon anterior edge of the free basi-occipital border.

December 10th.

The President, DR. HAYS, in the Chair.

Thirty members present.

Prof. E. D. Cope made some remarks on the contents of caves which abound in South-western Virginia. He stated that bones of all the recent mammalia of the country, including those of the Indians, were to be found in them, and 1867.]

that the process of deposit was continually going on. He mentioned his discovery of the remains of the floor deposit of one or more extensive caves in the limestone ridge in Wythe Co., Va., which produces largely the ores of lead and zinc. The roof and one side of the caves had been torn away subsequent to the period of deposit of the floor. The latter was of postpliocene age, and contained remains of mammals, birds, reptiles, amphibians, fishes and molluscs chiefly terrestrial. Among the first were tapir, peccary, deer, horse, small carnivora, shrews and several rodents; together, sixteen species. The deposit extended eight miles in length.

He also announced the existence of a postpliocene deposit in Charles Co., Maryland, near the Patuxent river, as indicated by the remains of the common peccary, a *Manatus* and a new carnivore of the genus *Galera*.

December 17th.

The President, DR. HAYS, in the Chair.

Twenty-three members present.

December 24th.

The President, DR. HAYS, in the Chair.

Sixteen members present.

The following papers were presented for publication:

"A Review of the species of *Amblystoma*." By E. D. Cope.

"On the Genera of fresh-water Fishes *Hypsilepis*, Baird, and *Photogenis*, Cope, their species and distribution." By E. D. Cope.

"On the Distribution of fresh-water Fishes in the Alleghany Region of south-western Virginia." By E. D. Cope.

"*Faeti Ornithologiæ*." No. III. By John Cassin.

The deaths of the following members were announced: Mr. Jacob Pierce and Mr. Richard M. Marshall; also Dr. Chas. Zimmerman and Rev. Dr. C. Dewey, Correspondents.

December 31st.

MR. VAUX, Vice-President, in the Chair.

Twenty-seven members present.

On favorable reports of the Committees, the following papers were ordered to be published:

An addition to the VERTEBRATE FAUNA of the Miocene period, with a synopsis of the extinct CETACEA of the United States.

BY E. D. COPE.

The species below enumerated were collected by James T. Thomas near his residence in Charles county, Maryland, not far from the Patuxent river, in the beds of the Yorktown epoch, in places where they are exposed by the cutting of various streams. The localities are twenty miles to the eastward of the outcrop of the eocene beds, and as those of the pliocene are at a considerable distance eastward of the eastern shore of the Chesapeake Bay, it is scarcely probable that there is any admixture of specimens from those formations. Two species in the collection of *Galera* and *Dicotyles* genera at present existing in South America,—the latter within our own limits also,—indicate the existence

[Dec.

of a post-pliocene deposit in the neighborhood, which has not been hitherto recognized.

In the miocene region, the beds of shells are of considerable thickness, and are composed of immense numbers of closely packed individuals of many species, in a very good state of preservation. They are, however, less silicified, and therefore more friable than those of the great beds at Yorktown.

The before-mentioned collection, which is now in the museum of the Academy, contained the following species of molluscs, etc., for the identification of which I am indebted to my friend T. A. Conrad :

| | |
|--|--|
| <i>Madrepora palmata</i> Goldf., | <i>Cyclocardia granulata</i> , |
| <i>Orbicula lugubris</i> , | <i>Carditamera protracta</i> , |
| <i>Ostrea trachydiscus</i> , Con., sp. nov., | <i>Astarte exaltata</i> , |
| <i>Ostrea thomassii</i> , Con., sp. nov., | <i>Astarte undulata</i> , |
| <i>Anomia multilineata</i> , | <i>Astarte cuneiformis</i> , |
| <i>Chama corticosa</i> , | <i>Astarte perplana</i> , |
| <i>Isognomon tortum</i> , | <i>Mercenaria staminea</i> , |
| <i>Pinna</i> , | <i>Mercenaria cuneata</i> , Con., sp. nov., |
| <i>Pecten madisonius</i> , | <i>Lucina americana</i> , |
| <i>Pecten jeffersonius</i> , | <i>Lucina foremani</i> , |
| <i>Pecten humphreysii</i> , | <i>Lucina contracta</i> , |
| <i>Pecten marylandicus</i> , | <i>Dosinia acetabulum</i> , |
| <i>Pecten clintonius</i> , | <i>Dione staminea</i> , |
| <i>Pecten virginianus</i> , | <i>Dione marilandica</i> , |
| <i>Pecten cerinus</i> , Con., sp. nov., | <i>Pliorhysis centenaria</i> , |
| <i>Axinæa lentiformis</i> , | <i>Sphærulea subvexa</i> , |
| <i>Arca callipleura</i> , | <i>Metis buplicata</i> , |
| <i>Arca improcera</i> , | <i>Glycimeris americanus</i> , |
| <i>Noëtia carolinensis</i> , | <i>Fissurella redimicula</i> , |
| <i>Corbula idonea</i> , | <i>Zizyphinus bryanii</i> , Con., sp. nov., |
| <i>Corbula pectorosa</i> , Con., sp. nov., | <i>Lunatia catenoides</i> , |
| <i>Cardium laqueatum</i> , | <i>Scala pachypleura</i> , C., |
| <i>Isocardia markoii</i> , | <i>Turritella indenta</i> , C., |
| <i>Isocardia fraterna</i> , | <i>Turritella alticostata</i> , |
| <i>Crasatella undulata</i> , | <i>Ecphora quadricostata</i> , |
| <i>Crasatella melina</i> , | <i>Bursa centrosa</i> , Con., sp. nov., |
| <i>Crasatella marylandica</i> , | <i>Balanus vulcanellus</i> , Con., sp. nov., |
| | <i>Balanus proteus</i> . |

ELASMOBRANCHI.

AËTOBATIS, Müll., Henle.

AETOBATIS ARCUATUS, Agassiz, Poiss. Foss. iii. Gervais, Palæont. Française, Tab.

This species, figured by Gervais, has existed in abundance during the period of deposit of the miocene beds. Two or three other species of the genus have left their remains in the same, which will be characterized at some future time.

AETOBATIS PROFUNDUS Cope, sp. nov.

This species is represented by numerous separated plates of the inferior dental series. They are therefore curved, and attached to their laminiform roots at a strong angle. The species was smaller than the preceding, judging by the portions preserved. The band-like teeth differ in their masticatory surface being convex or rounded, not plane, and having a much less projecting and lip-like convex margin. Their curvature is less, and does not approach the angulation of the *A. arcuatus*, and the width is nearly uniform at all points, and not narrowed at the extremities as in the latter. The laminar portion is relatively longer, having therefore a more extensive imbrication.

1867.]

| | Lines. |
|---|--------|
| Length of convexity of perfect tooth..... | 21.5 |
| " of chord " " "..... | 16.75 |
| Depth of laminar series..... | 6 |
| Width of masticatory surface..... | 2.75 |

MYLIOBATIS Cuvier.

The following are the first species of this genus which have been determined from the miocene age in the United States:

MYLIOBATIS GIGAS Cope.

This species is remarkable for the transverse extent of its median teeth, and its strong antero-posterior curvature. The latter is greater than the transverse curvature, which consists in the slope of the lateral dental series and of the extremities of the median teeth. Lateral teeth longer than broad, convex, in two rows. Median teeth well arched horizontally, but straight in their median portions, the length one-seventh the (straight) width.

Total length 3 in. 8 lines; width of median series 3 in. 2.5 lines. Sutures straight; surface smooth. (Remains of two or three individuals in the collection.) Should the proportions of this species have been similar to those of the *M. aquila* of the Mediterranean, the extent of its pectoral fins would have been not less than nine feet.

MYLIOBATIS PACHYODON Cope.

This species, also of large size, approaches near to the *M. holmesii* Gibbs, and *M. reglianus* Agassiz. It differs from the former in its median series of teeth being transverse and scarcely curved, and in the inferior laminæ being without V-like grooves; and from the latter in the depth of median teeth being half deeper in relation to the length, and in their greater transverse convexity. The specimen on which the species is founded consists of the lateral portions of four median and the single row of lateral teeth. The great depth of the vaso-dental layer is only equalled in the *M. holmesii*. The *M. stokesii* Agass. and *M. micropleurus* Agass., which resemble it in some particulars, differ in possessing two lateral series of teeth.

The lateral teeth are larger than broad.

| | Lines. |
|--|--------|
| Longitudinal width of median tooth band..... | 5.25 |
| Depth of vaso-dental layer..... | 7.75 |
| " of lamellar layer..... | 2.75 |

The transverse extent of the plate to a point which appears by the inferior curvature to be the middle, is 16 lines; the series has therefore probably been narrow.

MYLIOBATIS VICOMICANUS Cope.

Specimens of two individuals represent this species, which is of somewhat smaller dimensions than the two preceding, though one of the large species. One plate, extending over twelve median teeth, is flat antero-posteriorly, and nearly so transversely; the sutures of the median teeth slightly concave medially, and strongly convex at their extremities. Two lateral rows of teeth, which are longer than broad. Sutures straight. Vaso-dental layer shallow; where worn down in an old specimen, the surface is punctate all over through the section of the vascular canals.

| | In. | Lin. |
|--|-----|------|
| Total length of specimen..... | 3 | 2.5 |
| Transverse length of median teeth..... | 2 | 3.75 |
| Length of median teeth..... | | 3.75 |
| Depth of vaso-dental stratum..... | | 4.5 |

In the preceding three species the series of attaching laminæ are arranged in series oblique to the base of each tooth.

[Dec.

RAJA Linnæus.

RAJA DUX Cope.

This species is represented by a dermal plate, which was originally covered by enamel, and probably supported a spine; the latter, and a considerable portion of the former, have been lost. The form is unsymmetrically subpentagonal, longer than broad. One extremity truncate, the other obtusely narrowed. Inferior surface concave flattened; superior rising to a small median plane, edges thin. Greatest elevation near the narrow extremity, where the spine stood; a groove extends from the position of the latter to the margin. Surface indistinctly ribbed at right angles to the margin. Enamel with slightly wavy ribs, those near the centre much coarser than those near the circumference. Length of plate 15 lines; greatest width 12.75 lines; greatest depth 4 lines. A second plate, perhaps of the same species, differs in its narrower form; it is without enamel.

This ray was larger than any described from European tertiary.

NOTIDANUS Cuv.

NOTIDANUS PRIMIGENIUS Agassiz, Gibbes.

Fourteen teeth.

NOTIDANUS ELECTRODON Cope, sp. nov.

This species is represented by nine teeth, which are quite characteristic. It presents fewer denticles than any other species, and thus approaches distantly the *N. recurvus* of Agassiz. Large denticles but two, leaning obliquely in the plane of the root; the external denticle one-fifth the size of the median. Median denticle twice as high as broad at the basis, little inclined from the plane of the root; the cutting edge curved. Serrate edge very short, basal, in one specimen with no, in another four denticles. Section of root wedge-shaped.

| | |
|------------------------------------|--------|
| | Lines. |
| Length of root..... | 8.75 |
| Elevation of longest denticle..... | 6 |

Four teeth which I refer to a median position in the jaws of this species, have no lateral cusps whatever, but approximate those of some species of *Lamna* in form. Crown rather slender, subcylindric and slightly constricted at the base of the enamel, which is convex vertically and transversely at that point. This convexity is very strong to the apex of the tooth; the other side is still more convex. The crown is also very oblique in one or both directions. It is perfectly smooth, with lateral cutting edges. The latter disappears on the inner basis of the largest and most curved specimen. The enamel does not descend low on the outer face in the largest specimens. Tip little compressed; narrowed. Greatest length, 8.25 l.; of crown, 6.25; of root transversely, 6 l.

GALEOCERDO Müll., Henle.

GALEOCERDO APPENDICULATUS Agass.

GALEOCERDO LATIDENS Agass.

GALEOCERDO ADUNCUS Agassiz.

GALEOCERDO CONTORTUS Gibbes.

GALEOCERDO EGERTONI Agass.

GALEOCERDO ? sp. aff. contorto.

GALEOCERDO LÆVISSIMUS Cope, sp. nov.

This species is indicated by a large number of teeth. It is of the type of *G. aduncus*, but is characterized by the shortness of the root transversely as compared with the elevation of the crown, the convexity of the inner face of the latter, and the total absence of denticulations in any portion. The crown is oblique, the inner margin vertical in nearly all the specimens, the basal cut-

1867.]

ting edges short. The upper margin is not turned outwards, as in *G. contortus* Gibbes, and the section of both inner and outer faces everywhere convex. Base of the enamel inside either convex or plane; outer basis rising on the crown. Axis of medium spec. 5.25 l. Transverse extent of same, 6.75 l.

The apex of the crown is not nearly so oblique as in *G. aduncus*, though the specimens are, as in other species, more or less oblique or depressed, according to the position in the mouth. The species appears to be well marked.

SPHYRNA Rafin.

SPHYRNA PRISCA Agass.

SPHYRNA ? spec.

SPHYRNA MAGNA Cope.

This species resembles in its dentition a small *Oxyrhina*, with the basal portion much prolonged laterally, and crenate. The crown in the specimens is slightly to markedly oblique, rather narrow and stout, slightly bent outwards, with sharp, and entirely smooth cutting edges. Both faces are convex, the outer much so, the inner with a slight groove at base. The root rather short, slightly concave below, and prominent behind. The basal portion bounding the least angle is separated by an incised notch. One specimen is larger, more oblique, and with longer basis. Total elevation of medium specimen 7 lines; basis of same 6.5 lines. Larger specimen, axis, 7.8 lines; basis, 9 lines.

HEMIPRISTIS Agass.

HEMIPRISTIS SERRA Agass.

CARCHARODON Smith.

CARCHARODON ? ANGUSTIDENS Agass.

CARCHARODON MEGALODON Agass.

OTODUS Agass.

OTODUS OBLIQUUS Agass.

OTODUS APPENDICULATUS Agass.

OXYRHINA Agass.

OXYRHINA XIPHODON Agass.

OXYRHINA HASTALIS Agass.

OXYRHINA DESORII Gibbes.

OXYRHINA SILLIMANII Gibbes.

OXYRHINA MINUTA Agass.

LAMNA Cuvier.

LAMNA HOPEI Agass.

LAMNA DENTICULATA Agass.

LAMNA ELEGANS Agass.

LAMNA CUSPIDATA Agass.

LAMNA ? SUBULATA Agass.

TELEOSTEI.

SPHYRÆNA Cuv.

SPHYRÆNA SPECIOSA Leidy, Proc. Acad. Nat. Sci. 1856, p. 221.

TESTUDINATA.

TRIONYX Geoffr.

TRIONYX CELLULOSUS Cope.

Two small fragments of the carapace are all that represent this species. The sculpture is, however, exceedingly characteristic, and different from that of any either recent or fossil species known to the writer.

[Dec.

The surface is marked by numerous closely placed pits, which are remarkably deep, producing the vesicular appearance of scoria. The resemblance is heightened by the irregular size of the pits. Edges of septa rounded. The fragments are unusually thick, indicating a species of large size.

Lines.

Width of free portion of rib at origin..... 7·5
Depth of portion of carapace..... 4·33

TRIONYX sp.

An uncharacteristic portion of the carapace, which exhibits larger and more regular pits, separated by wider partitions. The pits at one extremity are larger than those of the other, and the septa narrower.

CHELONE Brongt.

CHELONE sp.

A proximal portion of the costal plate has a thickness of three lines, but rapidly thins out. Its surface exhibits transverse rugæ at its proximal extremity; elsewhere the rugæ are longitudinal, and more distinct on one side than the other.

CHELONE sp.

Two fragments of the carapace of a large and convex species, each with a strongly marked groove for the margin of the dermal shields. The surface is without sculpture.

CROCODILIA.

THECACHAMPSA Cope.

This genus resembles *Crocodylus* L., but differs in the entire hollowness of the external stratum of the crowns of the teeth, and their composition of closely adherent concentric cones. These internal cones, which number at least three, may be homologous with the included crowns of the successional teeth of other *Crocodylia*, but they must be regarded as functional in a physiological sense, since they compose the bulk of the crown of the tooth, within. They resemble in this respect *Mosasaurus*, and probably represent a genus near the *Mosasauridæ*. In none of the specimens at my disposal is the root preserved, though the width of the basal margin of the crown in *T. contusor* indicates its probable existence.

THECACHAMPSA CONTUSOR Cope.

This species is established on a single tooth. It is remarkable for its short conic form. The basis is circular, and its diameter is three-fifths the length of the tooth. The apex is rather acute and circular in section; it is directed to one side, and the tooth is slightly flattened on the inside of the curve. This face is bounded by a low obtuse ridge on each side, for the basal two-thirds of the crown, which are not distinguishable from a series of ridges which mark, at distances of a line, the basal three-fifths round the crown; they are less distinct on the convex aspect, and are separated by concave surface. Instead of the cutting ridges of the genus *Crocodylus*, the apex is provided with a narrow flattened plane on each side. The surface of this portion, and of much of the convex face, is marked by a minute decussating or chevroned sculpture. Vertical length, 14·5 lines; diameter of base of crown, 8·5 lines.

THECACHAMPSA SERRICODON Cope.

This species is based on a number of specimens of elongate conic crowns, which resemble to a considerable extent those of *Crocodylus antiquus* Leidy, of the same epoch. They differ from the *T. contusor* in their more compressed and elongate form, the presence of a sub-acute ridge on each side the apical three-fifths the crown, the absence of the lateral grooves, and the chevron sculpture. They are, on the contrary, minutely striate, and possess a silky lustre.

Length of medium specimen, 16·5 lines; base of crown, 9 lines.

1867.]

CETACEA.

Premising that a number of species whose remains occur in the present collection must, for the present, be passed by, I append a list of the extinct Cetaceans described from North American formations, up to the present time:

BALÆNIDÆ.

- BALÆNOPTERA PRISCA Leidy, Cope, miocene. Pr. A. N. S. 1851, 308.
 ESCHRICHTIUS CEPHALUS Cope, miocene.
 ESCHRICHTIUS LEPTOCENTRUS Cope, miocene.
 ? BALÆNA PALÆATLANTICA Leidy, miocene. Pr. A. N. S. 1851, 308.

DELPHINIDÆ.

- BELUGA VERMONTANA Thompson, Champlain. Nat. Hist. Vermont.
 DELPHINUS CONRADI Leidy, miocene. Pr. A. N. S. 1853, 35.
 LOPHOCETUS CALVERTENSIS Harlan, Cope, miocene. Trans. Nat. Acad.
 PRISCODELPHINUS HARLANI Leidy, miocene. Pr. A. N. S. 1851, 327.
 PRISCODELPHINUS ACUTIDENS Cope, miocene.
 PRISCODELPHINUS GRANDÆVUS Leidy, miocene. Pr. A. N. S. 1851, 327.
 RHABDOSTEUS LATIRADIX Cope, miocene.

CATODONTIDÆ.

- ORYCTEROCETUS CORNUTIDENS Leidy, miocene. Pr. A. N. S. 1853, 378.
 ORYCTEROCETUS CROCODILINUS Cope, miocene.
 PHYSETER ANTIQVUS Leidy, pliocene. Pr. A. N. S. 1853, 378.
 ONTOCETUS EMMONSII Leidy, miocene. Pr. A. N. S. 1859, 162.

CYNORCIDÆ.

- CYNORCA PROTERVA Cope, miocene.
 SQUALODON DEBILIS Cope, pliocene.
 SQUALODON WYMANII Cope, miocene.
 SQUALODON MENTO Cope, miocene.
 SQUALODON HOLMESII Leidy, pliocene.
 SQUALODON ATLANTICUS Leidy, miocene.

BASILOSAURIDÆ.

- DORYODON PYGMÆUS Cope, eocene.
 DORYODON SERRATUS Gibbs, eocene.
 BASILOSAURUS CETOIDES Geinitz, eocene.

Descriptions and notes on many of the preceding are given below.

ORYCTEROCETUS Leidy.

This genus differs from *Physeter* in the extensive pulp-cavity of the teeth, and the absence of surface cementum.

ORYCTEROCETUS CROCODILINUS Cope.

This species is based on a tooth belonging to an individual of one-third or one-fourth the size of the known species *O. cornutidens* Leidy, but nevertheless adult, as attested by the obliquely worn apex of the crown. The general form is that of an elongate curved cone, with flattened sides, and a broader convex face within the curve, and a narrower one on the outside. The tooth

[Dec.

is marked by numerous irregular transverse lines, similar to those frequently marking growth, and by longitudinal shallow grooves. The pulp-cavity extends for two-thirds the length of the tooth, being thus relatively deeper than in the known species, and is also very large, thinning the external wall out to an open basis. In the known species the walls are relatively thicker, and for a considerable distance parallel to each other. The form of the tooth is in some degree similar to the crown of the canines of some crocodiles. There is no enamel on the teeth of Cetaceans of this genus.

Total length, 2 inches 5 lines; long diameter at base, 8.25 lines; diameter at middle, 6 lines.

RHABDOSTEUS Cope.

This genus is either referable to a family not yet characterized, allied to the Platanistidæ and Delphinidæ, or belongs to the first named of these recent families.

Premaxillary and maxillary bones forming a cylinder, bearing teeth on its proximal portion, and prolonged in its distal portion into a slender straight beak. Teeth with the enlarged crown separated from the fang by a constriction.

This is one of the most remarkable genera of Cetaceans, and may be compared to its affines as Xiphias is to other Teleostei.

RHABDOSTEUS LATIRADIX Cope.

A portion of the muzzle of this species, which is preserved, measures 12 in. 7.5 lines in length, 12.5 lines in transverse, and 11 lines in vertical diameter at the base. The superior edge of the maxillary bone forms the external outline, while the remainder of this element is entirely inferior. The palatine face is convex, and the alveolar series approximated. The alveolæ themselves are longitudinal, two in .75 of an inch, and separated from each other by spongy septa. The vomer does not appear in the portion of the muzzle at my disposal.

| | |
|---------------------------------------|------|
| Width of premaxillary | 6 |
| " superior face maxillary | 4-75 |
| " palatine face of maxillary | 4-5 |

Three teeth are referred, with much probability, to this species. The fangs are from equal to twice the length of the crowns, and are much compressed, widening downwards, and more or less prolonged at one inferior angle, in the same plane. The crown, compressed transversely to the root, and expanded above the base, straight or slightly curved in the direction of its plane. Enamel smooth, edges obtuse. The compressed fang corresponds to the longitudinal alveolus, while the transverse dilatation of the crown is similar to the form of those of *Platanista*.

| | |
|----------------------------------|--------------|
| Length of largest specimen | Lines. 12 |
| " " crown | 5 |
| Width of fang | 3 |

Jas. T. Thomas, the discoverer of this Cetacean, tells me that he has seen portions of the muzzle between two and three feet long. From the gradual acumination of the individual here described, the length of the muzzle alone might have been at least of that length. A slender piece, evidently a portion of the premaxillary of a smaller individual, is fourteen inches in length. Its posterior portion is deflected, as if to give place to the prenasal triangle, and its inner margin descends abruptly to the same.

PRISCODELPHINUS Leidy.

In this genus the muzzle is elongate and flattened, and furnished with cylindrical fanged teeth, which extend throughout much or all of its length. The symphysis mandibuli is very elongate. The teeth have not been described. *Delphinus canaliculatus* von Meyer, from the Swiss Tertiary, appears to belong to it. (*Palæontographica*, 1856, p. 44).

PRISCODELPHINUS ACUTIDENS Cope.

This species is represented by a single tooth, which is apparently that of an adult of much smaller size than either of the known species of the genus. The fang is straight, fusiform, and cylindrical in section. It is constricted immediately below the crown. The latter is curved conic, the face within the curve bounded on each side by a low but acute ridge, which extends from near the acute apex to near the base. Enamel polished, smooth. Extremity of fang acute, solid.

Total length 7 lines; length crown 3.2 lines; diameter of base crown 1.4 lines.

LOPHOCETUS Cope.

Temporal fossa truncated by a horizontal crest above, prolonged backwards and bounded by a projecting crest, which renders the occipital plane concave. The same crest prolonged upwards and thickened, each not meeting that of the opposite side, but continued on the inner margins of the maxillary bones, turning outwards and ceasing opposite the nares. Front, therefore, deeply grooved. Premaxillaries separated by a deep groove. Teeth with cylindric roots.

LOPHOCETUS CALVERTENSIS. *Dolphinus calvertensis* Harlan. *Pontoporia calvertensis* Cope, Proc. Acad. 1866.

This species is near to the *Pontoporias*, but differs as above, so as to be referable to another genus. The form of the occiput indicates the insertion of powerful muscles, a condition which does not exist in any of the true *Cetacea* within the knowledge of the writer, excepting in *Inia* and in *Arionius*, von Meyer, from the Swiss Miocene. The latter genus resembles it also in the superior truncation of the temporal fossæ, but here all similarity ceases, for in *Arionius* the frontal bones are well developed, while in *Lophocetus* they are, as in true *Delphinidæ*, mere narrow transverse wedges. They are, indeed, much less developed than in *Pontoporia*, or even than in *Inia*.

The resemblance to *Inia* is closest. The only feature which renders a generic distinction certain is the cylindric form of the posterior alveolæ, which renders it probable that the teeth were not furnished with lobes as in *Inia*. In the latter the fangs have a transverse dilatation to support these. Harlan also states that but one and a half inches of the muzzle are broken away. If this be the case, the genus is short-muzzled and with the symphysis mandibuli not elongate. This is, however, exceedingly doubtful.

In *Lophocetus calvertensis* the nasal bones are separated by a deep fissure. The maxillaries exhibit, on each side in front of the external nares, two oval, roughened surfaces, which converge behind the nares. These appear to be insertions, perhaps for cartilaginous crests, comparable to the bony roofs of *Platanista*, less probably, for muscles connected with the external meatus.

The form of the muzzle is not as elongate as in the known species of *Pontoporia*, and it is much expanded, proximally, instead of contracted, as in the latter.

This dolphin approximated the larger white whales (*Beluga*) in size.

ESCHRICHTIUS Gray.

The genus *Megaptera* Gray embraces species of large size, living in the recent seas, known as the hump-backed whales. There are six species known, from different seas, of which one, *Megaptera ossiphya* Cope, occurs on the Atlantic coast of the United States. An examination of some specimens of periotic bones and vertebrae, from near Yorktown, Virginia, first indicated to the writer the existence of a supposed species of the genus, in the Miocene period, and it was mentioned in these Proceedings, 1865, 180. In the present collection the remains of an allied or the same species are preserved. These are, the premaxillary bones, nearly complete; the rami of the mandible, nearly

[Dec.

perfect; the first, third, fourth, fifth and seventh cervical vertebrae; several caudal and lumbosacral vertebrae, humerus, ulna, carpal bones and phalanges. The attachment of the epiphyses everywhere, indicate an adult animal.

In the genus *Megaptera* the transverse processes and the parapophyses of the second and succeeding cervical vertebrae are always separate, and not united at their extremities. Those of the second are usually very broad at their origins. The gular region is folded, and there is a knob on the back, representing the dorsal fin of the finner whales.

The above-named specimens, however, appear to belong to the genus *Eschrichtius*, recently established by Dr. Gray. It is near to *Megaptera*, differing technically in the presence of an acromion* on the scapula. As this piece is wanting, I rely on another feature pointed out by Gray, the great size of the neural canal, as compared with the vertebral centra. In the fin-backed whales, *Balænoptera* (*Balænoptera* and *Physalus* Gray), this author states its diameter to be not more than half that of the body; in the specimens before me it measures from six-sevenths to over two-thirds the latter, thus resembling the *Eschrichtius robustus*. It also exhibits the same affinity by the small size of the coronoid process.

Before considering the species from the Thomas collection, another species previously represented in our Museum may be noticed.

This, a second cervical vertebra from the Miocene of Eastern Virginia, differs from that of any known species in the slenderness and depressed form of its parapophyses, and in its transversely parallelogrammic form. It is without epiphyses, and is therefore part of a young animal, but when compared with the third cervical of the adult specimen above alluded to, is considerably larger. The vertical depth is the same in the two, but the transverse diameter of the Virginia specimen is 1.5 inches greater. The parapophyses are also nearly transverse in the latter; in the Maryland specimen, directed downward at 45° from the horizontal. I record it at present as—

ESCHRICHTIUS LEPTOCENTRUS Cope,

Since it is not likely to have pertained to the species already described by Leidy, *Balænoptera prisca* and *Balæna palæatlantica*. The former was described from a portion of a mandibular ramus, which, when restored, would have measured 4.75 feet in length, giving a total length of 21 feet. As there are no evidences of immaturity in the specimen, it is probable that its size was not greater than, if as great as, the existing *Balænoptera rostrata*.† Its affinity to this species is confirmed by the slender proportions, and great external convexity of the ramus. Its superior and inferior aspects are broad and nearly similar. The species is well distinguished. The *B. palæatlantica* is based on a portion of the mandible of an individual of not more than thirty-five feet in length. The inner face is more convex than in the last, and more so than in any known *Megaptera*. It also presents the peculiarity of two rows of vascular foramina, closely approximated on each side of the superior median ridge; this has not been observed in that genus or *Eschrichtius*.

The species from Maryland is near thirty-five feet long, according to the usual estimate. The *E. leptocentrus* has no doubt attained a considerably greater size, since its cervical vertebra is longer, and is that of a young individual. It will not be unsafe to ascribe to it a length of 50 feet.

| | In. | Lin. |
|--|-----|------|
| Transverse extent of centrum..... | 6 | |
| Vertical diameter..... | 4 | |
| Length of body (below, with epiphyses restored)..... | 1 | 8-75 |
| Distance between origins of dia- and parapophyses..... | 2 | 3 |

* The genus *Poseocopia* (?) Gray, established for hump-backed whales with a coracoid process, does not seem to differ from *Megaptera*, where that process sometimes occurs.

† A fine specimen of this species, over 30 feet long, went ashore during the autumn of 1866, on the Long Beach, N. J. It was much injured, probably by the killers. This species has not been before noticed on our coasts.

| | In. | Lin. |
|--|-----|------|
| Vertical depth odontoid elevation (under epiphysis)..... | 2 | 5 |
| Superior width " " " " | 1 | 10 |
| Diameter base of dia- and neuropophysis..... | 7.5 | |
| " neural canal (in part estimated)..... | 4 | 10 |

ESCHRICHTIUS CEPHALUS Cope, sp. nov.

The species whose remains are above alluded to as having been preserved by Jas. T. Thomas.

The atlas of this species most nearly resembles among existing Cetaceans the *Balænoptera rostrata*, in the width of the neural canal above, and the inferior position of the diapophysis and cotyloid articular face. That most essential point, the form of the dia- and parapophyses of the second cervical, not being attainable, owing to the absence of that piece, it becomes necessary to decide on the real relations to the *B. rostrata* on other grounds. The lack of elevated coronoid process of the mandible contradicts this affinity, while the narrowness and steeply descending angle of the parapophyses of the third cervical render it very improbable that the dia- and parapophyses of the second were united, if they observed their usual parallelism. This is confirmed by the fact that they are not united in the *E. robustus* Lillg.; though the parapophyses of the third have in it an almost transverse direction.

This species may be compared with the known species of this genus, and of Megaptera, as follows:

The third and fourth cervical vertebræ exhibit the quadrate form attributed to the *E. robustus* and *M. lalandii*, and the above-described *E. leptocentrus*. The form of the centra in *M. longimana* and *M. osphyia* is more ovate.

The parapophyses of the third cervical are flattened in the plane of the centrum; their axes are continuous with those of the combined dia- and neuropophyses, and the connecting lines cross at a superior angle of 50°. In the *E. robustus* these processes have a transverse direction, according to Lilljeborg. In the fourth cervical of the miocene species, the parapophyses have a still more vertical direction. The fifth and seventh cervicals are prominently rounded below, a feature not seen in the *M. lalandii* and *E. robustus*, and neither of them possess parapophyses. The floor of the neural canal is convex in all the cervicals, most strongly in the posterior. In *E. robustus* it is plane in Gray and Lilljeborg's figures; they are similar in the *E. leptocentrus* and in the Megaptera. The neural arches are more or less broken away, but enough remains in the third to give the width of the neural canal. The diapophyses of the fifth and seventh are directed backwards, and the bodies of all are convex in the same direction.

The atlas is notable for the want of a neural spinous crest, and in the inferior position and obliquity of the cotyloid cavity. The latter are separated by an inch below; in the same interval behind there is a transverse, very obtuse *tuberculum atlantis*. The inferior portion of the perforation, or *foramen dentati*, is much narrower than the neural arch.

| | In. | Lin. |
|---|-----|------|
| Vertical depth of atlas..... | 6 | 5.3 |
| " " " perforation..... | 3 | 9 |
| Total width of atlas (exclus. diapophysis)..... | 8 | 2 |
| " " " articular cotylus..... | 3 | 8 |
| Greatest transverse thickness atlas above..... | 2 | 4.5 |

The diapophysis is compressed, its base oblique, descending in front. The neural arch on each side is at right angles to the long diameter of the articular faces.

| | In. | Lin. |
|--------------------------------------|-----|------|
| Diameter of centrum third cervical.. | 4 | 7 |
| " " parapophysis at base..... | 1 | 2.5 |
| " " neur. diapophysis at base..... | 1 | 2.5 |

[Dec.

| | | |
|--|---|------|
| Diameter of neural canal (greatest)..... | 4 | |
| Depth centrum..... | 4 | 1 |
| Length "..... | | 9.5 |
| Transverse diameter of fifth cervical..... | 4 | 9 |
| " " " neur. diapophysis..... | 1 | 6.5 |
| Vertical "..... | 4 | 5.5 |
| Length centrum..... | | 10.5 |
| Transverse diameter seventh cervical..... | 5 | 3 |
| " " " neur. diapophysis..... | 1 | 8 |
| Vertical " " centrum..... | 4 | 5 |
| Length centrum..... | | 12 |
| " " " of an interior caudal..... | 5 | 2 |
| Vertical diameter of anterior face..... | 4 | 9 |
| Transverse " " " "..... | 5 | 7.5 |
| Height neural spine (worn)..... | 1 | 7.5 |
| Length diapophysis (worn)..... | 1 | 7.5 |
| Width of inferior concavity..... | 1 | 8 |

The caudal vertebra measured has the elongate form of those of the *Balænopteras*, and two strong inferior ridges, separated by each other by a deeper, and from the diapophyses by a shallower concavity.

A considerable portion of both premaxillary bones preserved shows an elongate muzzle; their form is narrow, especially towards their distal extremity, where they are much flattened; for a short distance posterior to that point they are subcylindrical and grooved.

| | | |
|--|-----|-----|
| | Ft. | In. |
| Length preserved (proximal end wanting)..... | 6 | 8 |
| Width near proximal end..... | | 3.5 |
| " " distal..... | | 2.5 |

The mandibular rami are massive, moderately curved, and considerably compressed, especially on their distal fourth. The interior face is everywhere nearly flat, the exterior convex; the superior ridge is rather acute; the inferior aspect obtuse, narrow. A series of large distant vascular foramina extend along the outer face some distance below the superior ridge. The coronoid processes have been broken off; their bases would indicate that they were compressed, and not elevated.

| | | |
|--|-----|-----|
| | Ft. | In. |
| Length of jaw to opposite coronoid..... | 7 | 0.5 |
| Total length (restored after <i>E. robustus</i>)..... | 9 | 4.5 |
| Depth one foot from extremity..... | | 4.8 |
| " " two feet in advance coronoid proc..... | | 8 |

The great length of the ramus as compared with the size of the cervical vertebrae is a remarkable feature. In two not distantly related species, following, they are:

| | Diam. vertebrae. | Ramus. | Total. |
|--|------------------|-----------|--------|
| <i>Eschrichtius robustus</i> (3d c.)..... | 8.75 in. | 8f. 2 in. | 47 |
| <i>Megaptera longimana</i> (1st d.)..... | 8.5 | 10.7 | 34.6 |
| <i>Eschrichtius cephalus</i> (7th c.)..... | 5.25 | 9.4 | 31 |

The proportion of the last cervical to the ramus is probably one-fourth less in the new species than in the second-named, and it might therefore be supposed that the head would bear a greater proportion to the total length than in *Megaptera longimana*, and thus approach the *Balæna mysticetus*. This great proportion is reduced by the indications furnished by posterior vertebrae which have the elongate form of those of the *Balænopterae*. This point being opposed to the other, it seems probable that the proportions most nearly approached those of the *B. longimana*, as above estimated, and that while this Cetacean possessed a larger head than the *Eschrichtius robustus*, its absolute length was less.

The form of the anterior limb presents us with a striking peculiarity of this
1867.]

species. It was remarkably short, approaching the species of *Balæna*, and differing from *E. robustus*, still more from the *Sibbaldii* and *Balænoptera*, and most from *Megaptera longimana*.

| | In. | Lin. |
|------------------------------------|-----|------|
| Length humerus..... | 11 | 8 |
| Least width..... | 4 | 4 |
| Distal "..... | 5 | 3 |
| Length radius (straight line)..... | 15 | 5 |
| Proximal width..... | 3 | 6 |
| Distal "..... | 4 | |

The humerus is flattened in one plane, and has an elevation near the middle of the infero-posterior margin, for muscular insertion. The shortness of the limb is a consequence of the small size of the radius and ulna.

Two carpals and one phalange are preserved. The former are as deep as wide, oval; one longer, and composed of two united centres of ossification.

| | In. | Lin. |
|-------------------------------|-----|------|
| Length of longest carpal..... | 2 | 6 |
| " " phalange..... | 3 | 2 |
| Width " "..... | 2 | 3 |

In conclusion it may be asserted that a rather more than usually fortunate coincidence in the preservation of important parts of the skeleton has enabled the writer to explain with some degree of accuracy the characteristics of this monster of the deep, almost the largest mammal of the miocene period yet known, but few of whose fellow leviathans have been as yet indicated by fragments only.

SQUALODON Grateloup.

Van Beneden Ac. Roy. Belg. 1865. *Phocodon* Agass., *Crenidelphinus* Laurill. *Macrophoca* Leidy, *Delphinoides* Pedroni, *Champsodelphis* Gervais.

This remarkable genus of Cetaceans, at one time supposed to be identical with the *Basilosaurus* (Harlan), has recently been greatly elucidated by the investigations of Prof. Van Beneden of the University of Louvain. The discovery of remains of more than one allied species in the neighborhood of Antwerp was the immediate stimulant to these researches. Jourdan and Van Beneden have proven the distinctness of this genus from *Basilosaurus*, in its much shorter cranial cavity, and posteriorly placed nasal meatus. The nasal bones are abbreviated and flattened, as in the whales, while those of the *Basilosaurus* are elongate, prolonging the nasal meatus, and throwing the nares far anteriorly. The latter thus approximate the *Pinnipedia*, while the *Squalodons* are more typical Cetaceans.

The present collection contains remains to be attributed to this genus, and which will be made subjects of illustration. At present a brief notice of dental features will suffice.

A considerable amount of variation among teeth situate in different positions in the jaws of the same species, has been shown in the above mentioned essay to exist. In consequence, remains, assigned by authors to various genera, have been, with much probability, referred to the genus *Squalodon*.* The same erroneous references had also been made in this country, but to a less extent. The remains on which these, and the present notices are based, indicate much parallelism between the marine faunae of the coasts of America and Europe, during the Yorktown Epoch.

Remains of nine individuals at my disposal indicate several species of this genus. They may be compared as follows with those already known.

* Prof. Van Beneden adopts this name, and rejects that of *Basilosaurus* for Harlan's genus, probably on the ground of the ill application of the latter to a genus of mammals. The application of the name *Squalodon* is, however, even more faulty, and it has not the merit of classic composition, like *Basilosaurus*.

I. Molars with two roots.

** Premolars with short conic crowns.

Premolars compressed, cutting.

Roots of premolars compressed.....S. *protervus*.

Promolars not compressed, bent.

Size small.

Premolars with crowns bent.....S. *wymanii*.

Size large.

Extremity of mandible much recurved; alveolae superior.....S. *mento*.Extremity of mandible little recurved; alveolae lateral.....S. *grateloup*ii.

** Premolars with elongate conic crowns.

Enamel of premolars smooth.

Roots of premolars very long.....S. *holmesii*.

Enamel of premolars ridged or striate.

Premolars striate; muzzle short, broad; molars serrate on both edges.....S. *ehrichii*.Premolars ridged; muzzle long, slender; molars serrate on both edges (except one or two anterior.).....S. *atlanticus*.Premolars ridged; muzzle long, slender; molars serrate only on the posterior edge.....S. *antverpiensis*.

II. Molars (or a portion of them) with three roots.

Denticles on the posterior edge only, step-like.....S. *gervaisii*.

Of the above species, the two rooted molars of *S. protervus*, *S. wymanii*, *S. mento*, and *S. holmesii* are unknown. It is, however, altogether probable, from the usual correlation with the form of the molar teeth, that there are three genera included in the preceding synopsis. Prof. Van Beneden states that probably the *S. gervaisii* will be found to pertain to an unnamed genus. Of this there is as yet little evidence, as the character of the three roots is not seen in a second molar figured by Gervais. The remaining species may be arranged as follows:

CYNORCA Cope, sp. *C. proterva* Cope.SQUALODON Grateloup, sp. *S. mento* Cope, *S. wymanii* Leidy, *S. grateloup*ii Von Meyer.COLOPHONODON Leidy, *C. holmesii* Leidy, *C. ehrlichii* Van Beneden, *C. atlanticus* Leidy and *C. antverpiensis* Van Beneden.

Lastly, may be added the gigantic ally of the above, described by Von Meyer and Van Beneden,

STENODON Van Ben. *S. lentianus* Von Meyer.

SQUALODON PROTERVUS Cope.

This species is represented in the collection by a single canine tooth, which presents the usual small crown and broad fang of the Cetacea. The fang is, however, shorter than in any homologous teeth in the other two genera above named and, with the crown, very much compressed in one plane. A shallow groove extends on each side of it to the narrowed and flattened truncate base. The tooth is widest at the middle of the fang; the crown is rapidly acuminate, narrow lenticular in section, and furnished with a rather thickened postero-internal cutting edge. The anterior or external aspect is worn away by the attrition of a corresponding tooth, but was obtuse, and furnished with a longitudinal ridge on each side at the base of the crown. The surface of the enamel is rugose, more minutely on one side than on the other. The tooth is considerably curved. While the enamel is polished, the fang is roughened and opaque.

1867.]

| | In. | Lin. |
|-----------------------------|-----|------|
| Total length on middle..... | 1 | 10.5 |
| Length of crown..... | | |
| Width at base of crown..... | | 4.5 |
| “ “ middle of fang..... | | 5.25 |

The length of the root of this tooth renders it improbable that it was a transitional molar, that is, intervening between the premolars and molars. Two teeth, having crowns similarly though rather more symmetrically formed, are in the Academy Museum, and these I suspect to have occupied that position. The present is more likely to have been an elongate tooth near the position usually occupied in Mammalia by the canines. There can be little doubt that the genus *Cynorca*, to which I refer it, will turn out to be well characterized.

The tooth of a closely allied animal is figured by Giebel, *Odontographia* xxxvi, 10, 11, 14, after Von Meyer. I have not been able to find the description of it, if existing.

SQUALODON WYMANII M. *Phoca wymanii* Leidy, Proceedings Academy N. Sci. 1856, 265.

Of this, the smallest species of the genus, three premolar teeth are in the collection, and the type specimen is in the Academy's Museum. The teeth are remarkable for the abrupt posterior direction of their crowns. The roots are curved, one of them abruptly so, and flattened.

SQUALODON MENTO Cope. Cetacean, Wyman, Amer. Jour. Sci. Arts, 1850, 230-232, figs. 4, 5, 6, 7.

This species is represented by four premolar teeth. The fang in these is thickest just below the base of the crown. No. 1 has a conic slightly curved crown, oval in section; it is grooved on the sides and minutely rugose elsewhere. The fang is polished, compressed, slightly curved in two directions, and grooved on its sides, one, the strongest, on the inner side of a curve and continuous with the grooving of the crown. At the base of the crown, on the side of the groove, is a light swelling. In Nos. 2, 3 and 4 the fangs are rugose, in No. 2 more cylindrical and slightly grooved laterally with open pulp cavity. Nos. 3 and 4 exhibit this cavity closed—in No. 4 by a distinct bony plug, and their fangs are much curved. In No. 3 the crown is smaller and more conic than in No. 1; it is rugose and furnished with a delicate continuous ridge on the outer and inner borders of its incurved plane. In No. 4 the crown is as broad at the basis as No. 1, but is much less elevated, and abruptly recurved. It is subtriangular in form, and is provided with a distinct tube at the base, behind the recurvature. The anterior outline of the crown forms the quadrant of a circle; it bears a rugulose cutting ridge, which is continued from the acuminate apex over the tubercle.

| | Lines. |
|----------------------------|--------|
| Length No. 1..... | 23.5 |
| “ “ crown (restored),..... | 7.5 |
| “ No. 3..... | 25.5 |
| “ “ crown..... | 7. |
| “ No. 4..... | 22.5 |
| “ “ crown..... | 6.5 |
| Width “ “ at base..... | 5.25 |

No. 1 approximates in position the transitional molar. A tooth, perhaps occupying that place or the next, has been figured by Dr. Wyman (*Supra* fig 4), as belonging to the genus *Phocodon* Agass.* The anterior premolars and a portion of the mandible, no doubt belonging to the same species, are figured in the same place as above. They belong to an animal much smaller than that to which the teeth above described pertain, and it is a matter of some question whether these specimens do not rather relate to the *S. wymanii* Leidy. The teeth, however, do not exhibit that abrupt flexure of the crown

* It also bears much resemblance to those of the recent *Inia*.

seen in the latter species. These premolar teeth bear considerable resemblance to those of the genus *Otaria*, and explain the reference of several of the species to seals by Gervais, Leidy and others.

If the *S. mento* be as I suppose, nearly allied to the *S. grateloupii*, it differs in the more recurved extremity of the symphysis, and the more vertical direction of the teeth. This comparison is, however, based upon the determination of Van Beneden, that the mandible figured by Gervais as *Champrodelphis macrogenius* (from Leognan near Bordeaux) really belongs to the *S. grateloupii*. A portion of maxillary and premaxillary bones with teeth, said by Gervais to belong to the former, obviously does not relate to the latter; hence the probability of the existence of another species to be called *S. macrogenius*. The teeth named by Gervais as *Phoca pedronii* and *Phoca* sp. (Tab. viii f. 8) are evidently those of a species allied to *S. mento*. Relying then on Van Beneden's determination, the *S. grateloupii* is more nearly allied to the two preceding species in the lack of long conical premolars and canine-like teeth, than it is to the species included here under the head of *Colophonodon*. In the latter these weapons are of great length and strength, and the anterior, according to Van Beneden, may be called small tusks. A species still smaller than the *S. wymanni* has been described by Leidy as *Phoca debilis*, from the Pliocene of Ashley River of S. Carolina. It will no doubt be found to be allied to *Squalodon* (vid. Pr. A. N. S. Phil. 1856, 265).

SQUALODON HOLMESII Leidy M. S.* *Colophonodon holmesii* Leidy. Proceedings Academy 1853, p. 377.

The size of this species was probably near that of the *S. mento*, and smaller than that of the *S. atlanticus*. Its geologic position is supposed to be the pliocene, while the other species of the genus have been discovered in miocene beds. It is, therefore, not represented in Thomas' collection.

SQUALODON ATLANTICUS Leidy MS. *Macrophoca atlantica* Leidy, Proceed. Acad. 1856, 220.

Remains of three individuals of this species before me indicate considerable variety in the forms of the two rooted molar teeth.

The individual from which Leidy determined the species is represented by only three true molars. Of these, the posterior, with more curved and divaricate fangs, is smaller, and presents four crests behind, and two in front. The next presents the same number of crests, with the addition of a basal rudimentary one in front. In the other molar, which has a slightly more elongate crown, three and a rudiment may be counted behind, and none in front.

The second individual is represented in the Thomas collection by the proximal portions of the maxillary bones of both sides, and seven molar teeth in place. At least four of the most posterior molars were inserted in oblique alveolæ, overlapping by their anterior fang the inner face of the posterior fang of the tooth in front. Anterior to these the alveolæ are less oblique, and separated by spaces. The palatal face is moderately convex, while the external surface is divided into two plane faces by an angulated line, which is strong posteriorly, vanishing anteriorly. These bones indicate a muzzle of proportions similar to those of the *S. antverpiensis* Van Beneden, and a cranium of thirty inches in length.

The teeth themselves, from their entire absence of worn surfaces, may be supposed to belong to a young individual. They are longitudinally wrinkled, and present a thick anterior and posterior cutting edge. The serrulations stand from behind, $\frac{3}{2}$ $\frac{3}{2}$ $\frac{3}{2}$ $\frac{3}{2}$, the anterior two of the last being very weak. The cutting edge of all these is serrulate. Not only in the number of the crests, but in the more elevate conic apex, do these teeth differ from those of the foregoing individual.

* Prof. Leidy informs me that he has arranged this and the succeeding species in the genus *Squalodon* in the MSS. of his work on North American extinct mammalia.

The third individual is represented by one true molar, and two caniniform premolars. The former is considerably smaller and more conic than the others, and exhibits a minute knob only on its anterior edge, to represent a crest. On the posterior aspect there have been three crests on the basal three-fifths the crown, worn off by mastication. The fangs are connected by a thin lamina, as in the second described specimen, and not, as in the first, by a thick wall.

One canine is larger, and with perfect root; the other smaller, a little more compressed, and without fang; it exhibits a rather large conic pulp cavity. The fang of the first is one-third longer than its crown; it is slender, slightly compressed conic, and without cavity at the extremity. The crown is coarsely striate and rugose between the striæ; two of the latter are elevated into obtuse anterior and posterior cutting edges. Diameter greatest at base of crown; latter slightly curved.

| | In. | Lin. |
|---|-----|------|
| Length of basis of large molar of No. 1..... | 13 | |
| Height of enamel of same..... | 10 | |
| “ “ “ in No. 2..... | 13 | |
| Length bases of 2, 3 and 4 molars (from behind), No. 2..... | 3 | 4.5 |
| Width palatine face at 3d molar, No. 2..... | 3 | 8.75 |
| Length canine, No. 3..... | 4 | |
| “ fang of do..... | 2 | 4.5 |
| “ basis of molar crown, No. 3..... | 11 | |
| Height of “ “ “ “..... | 9 | |

No. 1 was discovered in the miocene of New Jersey; the others were in the Thomas collection.

The question arises as to the specific identity of these individuals. The molar of No. 3 at once suggests a species different from No. 2 in smaller adult size, and lack of anterior denticles. It could not be considered as a transitional molar. These are shown by Van Beneden to be premolars, which assume traces of the characters of the true molars. The present tooth, in its form and double fang, is evidently a true molar. The discovery of the tooth of No. 1 without denticles, however, invalidates this peculiarity as a ground of difference in the present case, and furnishes a character of the species. Those whose dentition is known exhibit an abrupt commencement of characteristic true molars, without material approximation in the forms of their crowns to those of the premolars. The shorter apex and increased number of denticles on the posterior face in the specimen No. 1, I regard as an individual peculiarity.

The question as to the identity of this species with the *Sq. gratioleupi* depends in part on the identification of various short crowned teeth, described by Gervais as its premolars. The strong median angulation of the external face of the posterior part of the maxillaries, is a feature not described or figured as existing in the latter species. The affinity of the *S. atlanticus* is really nearer to the *S. antverpiensis* of Van Beneden, if it be not the same. The only characters which I can at present assign as distinctive, are the absence of denticles on the anterior edge of the molars throughout the series, and the non-overlapping of the four posterior of these teeth. The general proportions of the jaws and the form of the canine premolars are very similar in the two species. If, as I suppose, my description of No. 2 is taken from a young animal, its adult dimensions will exceed those of the *S. antverpiensis*.

DORYODON Gibbs.

Proc. Acad. Nat. Sci. Philada. 1845, 254. *Pontogeneus* Leidy, op. cit. 1853, 52.

This genus has been regarded as identical with *Basilosaurus* by Professor Müller, if, as is stated by Müller, l. c. (and Bronn, *Lethæa Geognostica*), the

[Dec.

species described by the former author is congeneric or identical with that described by Gibbes. Authors generally seem to have settled down to the belief in the identity of the two genera, the only exception being Prof. Van Beneden, who, in his essay on *Squalodon*, doubts the generic identity of *Basilosaurus macrospendylus* and *B. brachyspendylus* of Müller. Enough is now known of the Cetacea to render it certain that these two species cannot belong to the same genus, the elongate form of the dorsal vertebræ of the true *Basilosaurus cetoides* sufficiently characterizing that genus, as compared with the more usual Cetacean form of those of the present type. This feature was, however, not known to Gibbes, who endeavored to establish the genus on the hollowness of its teeth,—a character dependent, perhaps, on development.

DORYODON PYGMÆUS Cope. *Zeuglodon pygmæus* Müller, Ueber die Zeuglodonten, Berlin. *Pontogeneus ? priscus* Leidy, op. cit.

Eocene. Louisiana, Alabama.

DORYODON SERRATUS Gibbes, l. c. *Basilosaurus serratus* Gibbes, Journ. Acad. i. 10. *? Zeuglodon brachyspendylus* Müller, Ueber d. Zeuglodonten, 1849, 26. Tab.

Eocene. Alabama, South Carolina.

BASILOSAURUS Harlan.

Trans. Amer. Philos. Soc. Philada: 1834. *Zeuglodon* Owen, Trans. Geolog. Soc. London, 1839.

BASILOSAURUS CETOIDES Geinitz, Unters. ueber *Hydrarchus*, Dresden, 1847 (cum Carus et Reichenbach), Gibbes, Jour. Acad. Nat. Sci, 1847, 1.

Eocene. Arkansas, Alabama.

Supplement.

In the same collection are portions of mandibular rami of two species of terrestrial Mammalia, which would not appear to be referable to the same stratigraphic horizon. No beds regarded as postpliocene have as yet been indicated from the shores of the Patuxent, though the below-mentioned species have been most probably derived from such a deposit. These, with the other beds of other epochs, are buried under from ten to thirty feet of rather fine gravel drift.

DICOTYLES TORQUATUS Cuvier.

Portions of both rami of the mandible with permanent and deciduous molars and canines of a small individual. The former are similar to those described by Leidy in Palæontology of South Carolina, by Prof. Holmes, and closely resemble those of the common Peccary. They lack, however, the cingulum crossing the interspace between the external pair of tubercles.

GALERA MACRODON Cope, sp. nov.

This species is based on the greater portion of the right ramus of the mandible of an adult, containing three molars in place, the alveolæ of the first and of the last, with a considerable portion of that of the canine.

The alveolus indicates a canine of large size. The basis of first premolar is turned obliquely outwards, and is two-rooted. The second and third premolars are separated by a space; they have well-marked cingula, but neither posterior nor internal tubercles. The sectorial is elongate, more than twice as long as wide, the inner tubercle well marked, acute, the posterior lobe flattened, elongate; anterior lobe narrowed. Alveolus of the tubercular molar longitudinal, receiving a flattened fang with a groove on each side. Inferior face of ramus below anterior line of coronoid process, broad rounded, turned outwards. Masseteric ridge only reaching the latter below near the apex of the 1867.]

coronoid process, and not extending anterior to the line of the posterior margin of the tubercular molar. Ramus narrow at first premolar.

| | In. | Lin. |
|--|-----|------|
| Length of ramus from posterior margin canine to do. of tubercular..... | 1 | 5.5 |
| " to posterior margin sectorial..... | 1 | 3 |
| " third premolar..... | | 3.75 |
| " sectorial molar..... | | 6 |
| Width of same (posterior lobe) ... | | 2.8 |
| Depth ramus at posterior margin first premolar..... | | 7.5 |
| " " " sectorial..... | | 8.25 |
| Width " " " symphysis..... | | 4.5 |

This species appears to have been perhaps rather larger than the *Galera barbata* (Gray) of Brazil, and of a rather more slender muzzle. As compared with that species, it exhibits many peculiarities. The third premolar is smaller, and the first, the sectorial, and the tubercular relatively larger. In *G. barbata* the first molar has but one root, and the mandibular ramus thicker and deeper. The masseteric ridge advances to opposite the middle of the sectorial molar, and is continued on the inferior margin of the ramus, much anterior to its position in the *G. macrodon*.

The discovery of this species adds another link to the evidence in favor of the extension of neotropical types* over the nearctic region during the post-pliocene epoch. Of thirty continental North American species enumerated by Leidy (Ancient Fauna of Nebraska, 9), all but thirteen may be said to be characteristic of that, or closely allied to the species of the present period of North America. Of the thirteen, one (*Elephas*) is characteristic of the old world, of one (*Anomodon*) affinities unknown, and eleven are represented by members of the same family or genus now living in South America.

Among marine vertebrata, as among molluscs, the equivalency with the European beds of the same age is much closer. The following parallels exhibit this relation:

North American.

Aëtobatis arcuatus,
Myliobatis pachyodon,
Raja dux,
Plagiostomi sp.,
Priscodelphinus grandævus,
Balæna palæatlantica,
Squalodon mento,
Squalodon atlanticus,

European.

Aëtobatis arcuatus,
Myliobatis reglianus,
Raja ornata,
Plagiostomi sp.,
Priscodelph. canaliculatus,
? Balæna lamanoni,
Squalodon grateloupii,
Squalodon antverpiensis.

On the genera of Fresh-water Fishes *HYPHILEPIS* Baird and *PHOTOGENIS* Cope, their species and distribution.

BY E. D. COPE.

The two genera in question are among those represented by the greatest number of individuals in the streams of the eastern district (i. e., east of the Rocky Mountains) of our continent. *Hypsilepis* is distributed over the greater part of this area, while *Photogenis* abounds most in the Allegheny region, and always in the streams flowing through the Mississippi valley, as no species is known to occur in an Atlantic water. As we proceed northwards, the latter genus disappears with many others, one after another, while *Hypsilepis* still remains, and with its largest forms peoples the waters of the Great Lakes and the St. Lawrence.

* The genus *Galera*, Gray, is here regarded as distinct from *Galeotis* Bell (*Grisonia* Gray), as it possesses an internal tubercle on the inferior sectorial, which is wanting in the latter.

The food of both genera consists of insects, though *Photogenis* only has the pharyngeal teeth without grinding surface. In the latter genus the dorsal fin is above the ventrals; in *Hypsilepis* it varies from a little anterior to considerably posterior. The large scales of the lateral line in *Hypsilepis* are so extensively imbricate as to leave but a narrow margin exposed, giving a character and name peculiar to the genus. Teeth in the longer row in both 4—4.

HYPSILEPIS Baird.

This genus was first outlined by Prof. Agassiz, in his work on Lake Superior; it was then partially defined by Dr. Storer in his *Fresh-water Fishes of Massachusetts*, and later more fully by Girard, *Pr. A. N. Sci.* 1856. Girard has enumerated the species, which are here reviewed with the exception of two,—viz.: *H. obesus* (*Leuciscus* Storer), from Alabama, and *H. gracilis* (*Leuciscus* Agass.) These are described in such an imperfect manner as to leave no alternative but to omit them from this essay.

There are two coloration types in the genus, one where the species are adorned with red pigment (Sections I. and III.), and (Sect. II.) where a white pigment is deposited. These are most brilliant during the season of deposit of eggs, and vanish in some species later in the season. In the *H. coccogenis* much of the brilliant coloration remains throughout the whole year. There are few sights more pleasing than the brilliant crimsons of these fishes rapidly reflected in the pure water of the mountain streams, especially where species of other genera, as *Clinostomus*, *Chrosomus* and *Argyreus* vary the hues with gold and black. These are as the bright birds to the forest, or flowers to the field, in the otherwise monotonous life of the waters.

Section III. approximates *Alburnellus* in the position of its dorsal fin. In Section II. *H. analostanus* occasionally exhibits masticatory surface on two or even on one tooth only, thus approximating *Cyprinella* Girard. The *Cyprinella cercostigma* Cope is of much the same type, but is without this surface, indicating the close approximation of the two genera. This species may be established as follows, prefatory to an examination of the true *Hypsilepis*:

Cyprinella cercostigma Cope, sp. nov.

Teeth 2·4—4·2, with sharp, serrate edges. Dorsal fin inserted two scales behind that above insertions of ventrals. Dorsal line compressed elevated, rising regularly from end muzzle. Cranium convex above; muzzle narrowed in profile, slightly overhanging mouth. Eye 4·33 in length of head, 1·5 in length muzzle, and 2 in interorbital width. End maxillary opposite posterior margin nares. Ventral outline less curved than dorsal; caudal peduncle rather stout; isthmus narrow. Scales rather elevated, 8—39—3. Lateral line gently decurved over ventrals.

Head 5·25 times in total length (4·25 to origin caudal), one scale less than depth at dorsal. The pectorals nearly reach the ventrals, and the latter attain the vent. Radii A I. 8. C. + 19 + A. I. 8, the longest ray $\frac{4}{3}$ its base, and $\frac{3}{4}$ distance to longest fulcrum at origin caudal. Total length 4·52 inches; depth ·95 inch.

Color bright olive above, without line or spot; below and sides from fifth lateral row of scales above, golden silvery. All the fins except the pectorals with white pigment at their bases, without markings; a large round black spot at base of caudal.

Habitat.—Pearl River, Mississippi, at Monticello. Helen Tonnison's coll. in Mus. Smithsonian, Washington, D. C. Four specimens.

I. Dorsal fin above or anterior to ventrals; teeth 2·4—4·2;
anal radii I. 9.

Head more elevated, decurved above, mandible included; mouth slightly oblique; eye over four times in length of head. Dorsal and caudal neither black nor yellow-banded..... cornutus.

1867.]

Head nearly plane above; mandible projecting beyond muzzle, mouth very oblique; eye less than four times in head. Dorsal black bordered; caudal yellow at base; head red striped... *coccogenis*.

II. Dorsal fin a little behind above ventrals; teeth 1·4—4·1; anal radii (usually) I. 8.

Head flat, descending, mandible included, mouth horizontal; eye nearly five times in head. Dorsal with a black spot behind; caudal yellow at base, head not striped; teeth smooth; larger *galacturus*. Similar to the last, but smaller; the teeth more or less crenate, and the basal half of the caudal fin is not colored; a black scapular band *analostanus*.

III. Dorsal fin well behind above ventrals; teeth 2·4—4·2; anal radii I. 11.

Head short, deep, eye entering 3·5 times; small, depth 3·75 in length; lateral line much decurved, scales 16—44—3, not black-edged; dorsal black at base..... *diplemia*

Head flat, elongate; mouth very oblique; eye three and a-half times in head; small, depth one-fifth length without caudal; scales black-edged above 9—50—3. Dorsal black at base; lateral line little decurved..... *ardens*.

HYPsilēpis cornutus Mitchell.

Girard, in Storer, Trans. Amer. Acad. Arts Sciences v. 1855, 118. Proc. A. N. Sci. Phila. 1856, 212. *Cyprinus* Mitch., Amer. Month. Magaz. N. Y. I. 324. *Leuciscus cornutus* Storer, De Kay.

This is one of the most widely distributed of our Cyprinidæ, occurring from Nova Scotia and New England through the middle and western States to beyond the Mississippi, and in the Roanoke and Tennessee Rivers southwards. In the waters of the Susquehanna and Delaware basins it is, with the *Argyrens atron asus*, the most abundant species. It prefers clear waters, and does not haunt rapids.

The best figure of this, as well as of some of our other Cyprinidæ, is given by Dr. Storer in his excellent Monograph on the fishes of Massachusetts.

This species is represented in its distribution by a greater amount of variation than any other of the family with which I am acquainted. The varieties are constant in a great number of their individuals. They may be enumerated as follows:

H. c. *gibbus*, Proc. Acad. 1864, 279.

Seven specimens from Monroe county, Mich. Scales large, six rows above lateral line, sixteen anterior to dorsal fin; it differs from the following in the great elevation of the outline in front of the dorsal fin, and other points. From the first dorsal ray the outline again descends, giving the fin a very oblique position; this extends also, when laid back, as far as above the fifth anal ray, while in *frontalis* it most usually reaches a point opposite the first ray only. The eye is contained four times in the length of the head—more frequently four and a half times in *frontalis*. The length of the head measures in the depth of the body, from the dorsal outline to the middle of the row below that bearing the lateral line; it extends nearly to the ventral outline in *frontalis*. The pharyngeal bones appear to be relatively rather stouter than in typical *frontalis*, and are not furnished with so prominent an inferior angle to the external ala. This, with the form of the body, would almost indicate a species; but as I find approximations in these and transitions in the other characters, I cannot so consider it.

H. c. *frontalis*. *Leuciscus frontalis* Agassiz, Lake Superior, p. 368. *Hypsilēpis frontalis* Cope, l. c. 279.

[Dec.

Scales of dorsal region larger; fifteen to eighteen in front of dorsal, six above lateral line. From various streams flowing into Lakes Huron and St. Clair. Lake Superior, Agass. Holston River, Virginia, abundant. Orbit in specimens 3 in. 9 l. in length, 3.5 times in head; in specimen 7 in. 3 l., 4.75 times in head. The latter have the interorbital region arched in section, and the vertical diameter of the orbit 3.74 in the same of the head. The former, the interorbital region flat and the orbit twice in the head as before. The large specimens have a black scapular bar. They all belong to one variety.

H. c. cerasinus.

This variety is represented by specimens of rather small size, and with large scales: 6—40—3; 16 in front of dorsal fin; orbit 3.25 in head of a specimen 3 in. 9 l. in length. Head four times in length. This is a most beautiful species in the spring and summer; it is entirely deep rose, the inferior fins crimson, a dorsal and two lateral metallic golden lines; the latter only visible in life and in certain lights, as in the other varieties. Head waters of the Roanoke.

H. c. cornutus. *Leuciscus cornutus* Mitchell. *Leuciscus plargyrus* Rafinesque hinc *Plargyrus typicus* Girard. *Plargyrus bowmanii* Girard, Proc. Acad. 1856, 196 (from autopsy).

Scales of dorsal region smaller, 22 to 24 in front of dorsal fin; on sides 8—41—3.4. Dorsal region blue in spring; fins, chin and muzzle red. Dorsal region convex and compressed to dorsal fin, the head four and one-quarter times in length to base of caudal fin, and four-fifths of greatest depth of body; vertex concave, muzzle obtuse rounded; mouth terminal, end of maxillary terminating opposite posterior nostril. From end muzzle to dorsal (1st ray) $\frac{1}{3}$ this from latter to origin of caudal. Ventrals origin exactly under first dorsal, broadly truncate, not quite attaining vent. Base of anal nearly equal its anterior ray, outline slightly concave. Base of dorsal two-thirds height anteriorly. Pectoral anterior rays shortened, medial not quite reaching the ventral. Operculum one-third higher than long. Eye, diameter one-fourth length of head, and once below its rim to upper preopercular ridge. Frontal width one-half length head above. Scales $\frac{8}{1}$, about twenty-three on the dorsal line in front of third dorsal fin. Radial formula D. 1. 8; C. 4. 19. 5. A. 1. 9. V. 8; P. 1. 15. Coloration of an adult male: dorsal region as far down as the fourth row of scales dark impure blue, divided by an indistinct band of yellowish-olive one and a-half scales wide, which follows the outline of the back; bordering the dark below is a luminous line which does not attain the tail, which is very visible in the water, and from above when wet and out of water. Sides from rosy to silver-white, the scales in adults blackish at bases; anal, ventral and pectoral fins bright crimson in spring and summer, in males. Operculum rosy, head dark above. The males in spring have the branchiostegal membranes and the chin bright crimson.

Total average length 5 in. 7 lin.; head 1 in. 1 l.; end muzzle to base anal 3 in.; depth at dorsal 1 in. 4 l.; at anal 11.5 l.

The above description is taken from an adult from the Conestoga in Pennsylvania, tributary to the Susquehanna. It applies equally well to all individuals of the species, except as pointed out under the heads of the varieties, respectively. Nevertheless, the specimens from the Susquehanna are frequently distinguishable from those of the Delaware. Numerous specimens from Michigan agree with the former in having a more elongate form of head and body than specimens from tributaries of the Delaware. They often differ from those of the Susquehanna in having a row of scales more below the lateral line. In Delaware specimens the head is shorter than in the latter, not more so than in the former, but the depth of the body is greater than in either, entering in length to base of tail $3\frac{1}{2}$ times—in the others 4 and $4\frac{1}{2}$ times. The dorsal fin is a little more anteriorly situated in the Delaware specimens, and there is a row of scales more below the lateral line than in Susquehanna specimens. 1867.]

mens. With typical specimens only, these might be regarded as representing two species, and as such I have already alluded to them; but in the large number of individuals at my disposal, I find transitions in all the points. The Delaware specimens more nearly resemble the *H. cornutus*, figured by Dr. Storer.

General Habitat.—Eastern, Middle and Western States; head waters of the James River. There is nothing in the description of *Plargyrus argentatus* Girard (l. c. 212), from the lower James River, to distinguish it from this variety.

H. c. cyaneus.

Scales of the whole dorsal and ventral regions very small, 31 to 40 in front of dorsal fin; on sides 10—40—4. Colors very dark; above blackish-blue, all the scales black at their bases; head entirely black; pectorals black; ventrals with a broad black band and red tip; anal black in front, dorsal chiefly black; membrane of caudal blackish. In a specimen 5 in. 10·5 lines long, the orbit enters the head 4·5 times. Small tubercles extend from muzzle to vertex, are numerous on the sides of the former to rictus oris, and form a strong crest on mandibular and suborbital bones.

This well-marked variety was taken in the Montreal River, Keeweenaw Point, on Lake Superior, by John H. Slack, M. D., to whom the Academy is indebted for a number of specimens.

HYPHILEPIS COCCOGENIS Cope.

Spec. nov.

The general form of this fish is moderately stout, the head elongate and straight, with large eye. The caudal peduncle is neither narrow nor broad; the dorsal outline very little elevated. Length of head four and a quarter times in total without caudal fin; greatest depth scarcely less than length of head. Diameter of eye three-fourths of frontal width, and greater than distance between its lower margin and gular plane. Scales of typical form 7—42—3. The fins rather small; pectorals extend little more than half way to ventrals, and the latter do not reach the vent. External margin of anal as long as from end of muzzle to preopercular line, or as long as pectoral; front margin of dorsal equal the same, and greater than posterior margin of same.

The colors of this fish are very pleasing. Belly and sides silver white, or in the breeding season rose-colored, bounded above the lateral line by a leaden shade. Back olive, with sometimes a brown dorsal band, sometimes the scales heavily black margined. The head blackish above, and a deep black band on the scapular arch. Muzzle and lips with a broad band behind the edge of the preoperculum and axillary spot, crimson. Dorsal fin broadly black-banded on margin, yellowish-banded medially, and crimson at base. Colors of the caudal similar, without the crimson; inferior fins milky white.

Dimensions of an adult specimen:

| | In. | Lin. | | In. | Lin. |
|------------------------------|------|------|------------------------|-----|------|
| Total length..... | 5 | 2 | Depth at occiput..... | 1 | 8·5 |
| Length muzzle and chin. | 4·5 | | “ at dorsal. | 1 | |
| Diameter orbit..... | 3·75 | | “ at caudal peduncle.. | | 5·25 |

This species is only second to the *H. cornutus* in size, and first in the genus in beauty. Its particolored fins and crimson cheek stripe render it easily recognizable. The latter feature gives it its name. It occurs in abundance in the clear and often rapid creeks that flow into the north and middle forks of the Holston River in Virginia. Taken in the Ninth month.

HYPHILEPIS GALACTURUS Cope.

Spec. nov.

The general form of this fish is fusiform, the inferior and superior outlines converging equally. The superior cranial outline descends gently and equally; the muzzle is more than usually prolonged beyond the mouth. The end of the

[Dec.

maxillary stands opposite the nares. The eye is smaller than in the other species, excepting *H. analostanus*, entering 5.5 times the length of the head in old specimens. The head enters the total (exclusive of caudal fin) 4.3 times, and the greatest depth 4.6 times. The exposed surfaces of the lateral scales are not so much narrowed as in the other species, and the lateral line is but little decurved; nos. 6—41—3; eighteen anterior to the dorsal fin. Small tubercles appear on the top of the head, the patch narrowed behind, and the sides of the muzzle. The pectoral fins reach three-fifths the distance to the ventrals, the latter the vent. The anal is larger than in most species, its outer margin as long as from end of muzzle to middle of operculum. Dorsal elevated, the height equalling depth of body at first anal ray in a male. Rays D I. 8. C+19+. AII. 9. V. 8. P. 14.

Dimensions of an adult:

| | In. | Lin. | | In. | Lin. |
|----------------------|-----|------|---------------------------|-----|------|
| Total length | 5 | 4 | Depth at occiput..... | 8 | 25 |
| Length muzzle..... | 3 | 75 | " dorsal..... | 11 | 75 |
| Diameter orbit | 2 | 75 | " caudal peduncle..... | 5 | 75 |

In life this species is steel gray above, and silver beneath; the inferior fins are milky, and the dorsal and caudal iron grey sprinkled with blackish. The hinder portion of the former has the membrane black and the rays cream colored, and the whole base of the caudal is cream yellow.

This fine species is abundant in the tributaries of the Holston River in Virginia. Many specimens are in the museum of the Academy.

It resembles the *H. analostanus* in its proportions of eye and head, but is more elongate in body. The largest specimens are more than twice the size of the largest of the latter.

HYPSILEPIS ANALOSTANUS (Girard) Cope.

Leuciscus kentukiensis Kirtl. Journ. Bost. Soc. Nat. Hist. V. p. 27 (not of Rafinesque). *Cyprinella* do. Cope, Proc. Acad. Phila. 1854, 279. *Hypsilepis* do. Cope, Trans. Am. Phila. Soc. 1866, 371. *Cyprinella analostana* Girard, Proc. Acad. Phila. 1859, 58. Cope l. c.

The dorsal and ventral outlines are regularly and gently arched from the end of the muzzle and contract to a caudal peduncle of about the depth of the head at the middle of the orbit. The dorsal region is quite compressed, the ventral narrow but not carinate in front of the vent. Eye round, contained 4.5 times in length of head, and 1.5 in length of muzzle; the latter is narrowed and projects slightly beyond the mouth, most so in males in breeding season. Oral margin arched, end of maxilla opposite middle of nares. The greatest depth of the body is greater than the length of the head, and enters the total (including caudal fin) four and one-fifth times. Tail short, deeply and concavely emarginate. Anal fin less developed than dorsal, its base nearly equal height of first ray, and just exceeding base of dorsal; latter a little over $\frac{2}{3}$ greatest elevation of the same.

General color leaden silvery, darkest on the sides, the scales above and below, a dorsal band and large spot on hinder part of dorsal fin, blackish; top of head and median margin of anal fin shaded with the same. In spring and summer the inferior fins, and even the tips of the caudal and anterior part of the dorsal, are filled with a satin white pigment, which has a very elegant effect, and gives the fish its local name of "Silver Fin." At the same period the head and muzzle of the male are studded with small tubercles, as follows: a conic accumulation on the end of the muzzle, prolonging it; a series round the mandible, also over the orbit, from an agglomeration on the preorbital bone; a double series of larger tubercles on each side the frontal region, which join between the nares and on the parietal region; scattered series on the temporal region.

Total length 3.375 inches; caudal 5; from its base to first ray of anal 1 in.; to first dorsal ray 1.44 in.; from latter to end of muzzle 1.56 in.

This species is abundant in the various tributaries of the Ohio; it is also common in all the waters of the Susquehanna examined (Octoraro, Conestoga, Juniata, Meshoppen) and in the Potomac (Girard); from the Delaware I know it from the neighborhood of Trenton (C. C. Abbott) and Philadelphia (J. Burk), Conshehocken on the Schuylkill. From the James River, Va.

It is also abundant in the Kanawha and its tributaries, but is not known from the Holston. It is chiefly to be found in the quieter parts of river channels and back waters, being comparatively rare in creeks.

Dr. Girard described specimens of this species from the Potomac as distinct from those of the Ohio, without making comparisons. I undertook to substantiate the differences and gave the following as distinctive features of the Eastern and Western fishes:

Head $3\frac{2}{3}$ to 4 times in length to base of tail. Scales $\frac{5-(6)}{2-(3)}$ 32-5 for the Eastern.
 Head $4\frac{1}{2}$ times; muzzle more acute. Scales $\frac{6-7}{3-4}$ 38-40 for the Ohio type.

These represent the tendencies of the individuals of these regions correctly, but the exceptions to the rule are not rare; thus a Schuylkill specimen before me exhibits a head $4\frac{1}{2}$ times in length and has an acute muzzle, scales of lateral line 38. Seven rows of scales above the lateral line in a Youghiogheny specimen, include some abnormally intercalated, but not a true series; about half the Delaware specimens exhibit six. Four rows below the lateral line has resulted from counting an elevated abdominal series. In two Ohio specimens the anal radial formula is identical with that of the eastern, 1.9, while in five the formula is 1.8. Thus this species exhibits an unusual range of variation.

Dr. Kirtland identifies this species with the *Leuciscus (Luzilus) kentuckiensis* Rafinesque, but this cannot be correct, as the latter is described as having red fins, a characteristic always wanting in the *H. analostanus*.

HYPHILEPIS DIPLEMIA Raf.

Leuciscus diplemia Raf., Ichthyologia Opiensis, p. 50. *Luzilus* do. Kirtland, Bost. Journ. N. H. 1845, 276, Tab. *Plargyrus* do. Girard, Proc. Acad. Phila. 1856. *Hyphilepis* do. Cope, l. c. 1864.

This species has somewhat the form, as it has the coloration and minute nuptial excrescences of the species of *Clinostomus*; as in them, the dorsal fin commences slightly behind above the origin of the ventrals; its hinder margin is opposite the origin of the anal, to which the ventrals attain. Anal elongate, its last ray horizontal, outline behind, vertical concave. Dorsal elevated, rounded above, length of first articulated ray one-half from its base to base of caudal. Radial formula D I. 9 P. 12. V. 8. A I. 11. C. +18+. Dorsal outline elevated, superior line of cranium scarcely arched, head rather compressed; body rapidly narrowing to caudal peduncle at dorsal and anal fins. Caudal expanded, deeply emarginate.

In the breeding season minute asperities cover the dorsal line in front of the dorsal fin, and appear on the upper and lower aspects of the head. The latter are most abundant on the preorbital region; on frontal region sparse, minute. Rows on the superciliary and lower edge of suborbital regions, and two on each ramus mandibuli.

Length of head four times in length to base caudal, and less than depth of body. Scales of anterior dorsal region much smaller than those of the lateral; latter with exposed surfaces very narrow, and crested with minute tubercles in the breeding season.

Color, dusky above, the sides and belly silvery without band; below crimson

[Dec.

in spring. A large black spot at base of dorsal fin. Length extends to four inches, according to Prof. Kirtland; of a specimen in Museum Academy, from Lansing, Michigan, 2 inches to origin caudal; 12.5 lines to origin dorsal; 6 lines to opercular margin; depth 7 lines.

Prof. Kirtland states that it is abundant in all western streams, and that it ascends rapids in shoals in spring for the purpose of depositing its eggs.

HYPSILEPIS ARDENS Cope.

Spec. nov.

Length of head 4.33 times in total; orbit equal muzzle, its anterior border reached by the end of the maxillary; mandibular symphysis projecting slightly beyond the end of the muzzle. About 26 rows of scales in front of dorsal fin. Anterior dorsal ray opposite the middle of the ventral, the posterior opposite the first anal. The first anal nearly as long as the longest dorsal, the fin elongate, concave behind; it is nearly reached by the ventrals. Pectorals extend half way to ventrals. Cranium slightly arched transversely above; inter-orbital space .25 greater than diameter of orbit. Opercular and preorbital bones deeper than long.

Dorsal region yellowish olive, the scales black edged to middle of sides, all rose shaded. Sides, belly and head rosy crimson, muzzle approaching vermilion; suborbital region purple. Dorsal and anal fins vermilion, the former black at base; pectorals and ventrals rose. Caudal orange red, black lined.

Length of largest specimen 3 in. 2.5 lines; to base dorsal 17.5 lines; latter to base caudal 14.5 lines. Depth at orbit 3.5 l.; at first anal ray 5.25 l.; at constriction caudal peduncle 3 l.

Habitat.—The head waters of the Roanoke River (in Montgomery Co., Virginia). One of the most richly colored fresh-water fishes.

PHOTOGENIS Cope.

Trans. Amer. Philos. Soc. 1866, 378.

This genus was established for species agreeing in general characters with *Hybopsis*, but resembling *Alburnellus* in dentition. The mouth is not small, the orbits and scales are large, and the form generally slender. The species frequent clear streams, are less common in swift rapids, and never occur in stagnant or muddy waters. They are ornamented with lustre almost exclusively, and do not develope conspicuous horny tubercles.

The present collection contains three new species of the genus, which are here added to the three already known:

A. Anal radii I. 10, in one species I. 9. (No black spot at origin of caudal fin.)

aa. Dorsal fin much nearer origin caudal than end of muzzle.

Scales (5) 6—39—40—3. Diameter eye equal length muzzle; 3.3 times in head; latter 4 to 4.5 in length; depth in same 5.6—5 times; above olive; sides silver, in a band on caudal peduncle. Anal radii I. 10..... *P. leucops*.

Frontal width three-fifths orbit. Scales 7—35—3. Orbit diameter greater than length muzzle, 2.75 times in head; depth 4.75 in length; lateral line much decurved; silvery below, fins unspotted. Anal radii I. 9..... *P. ariommus*.

a. Dorsal fin equidistant between origin caudal and end muzzle.

Scales 4 (5)—36—40—3. Diameter of eye exceeding length of muzzle, 2.75 times in length of head; latter 4.5 in length,* depth 5 times. Head above and edges dorsal scales blackish; sides and belly silver..... *P. telescopus*.

* Always to origin caudal.

A.A. Anal radii 1. 8.

a. A black spot at origin caudal fin.

Scales 5—38—40—3. Orbit equal muzzle, 3.3—3.5 times in length head; latter 4.5 in length. Olive scales above brown edged; sides silver, with a purple band; muzzle and base dorsal red..... P. leuciodus.

aa. No black spot at base caudal.

Head narrower. Scales 6—38—2. Orbit less than length muzzle, 3.5 times in length head; latter times in total; depth five times in same. A leaden lateral band; middle caudal and spot on dorsal black..... P. spilopterus.

Head broad, frontal width equal diameter orbit, which is greater than length of muzzle, one-third length head. Scales 5—6—38—3. Head 3.75—4 times in length; depth 4—4.5 times..... P. scabriceps.

PHOTOGENIS LEUCOPS Cope.

L. c. *Squalius* (*Clinostomus*) *photogenis* Cope, Proc. Acad. Nat. Sci. Phila. 1864, 280.

A species resembling some *Alburni* in its large caducous scales and attenuated form. Eye over one-third head, round. Mouth quite oblique; under jaw scarcely projecting; maxillary not reaching line of margin of orbit. Head entering four and two-thirds times into length to fork of caudal; greatest depth seven times. Back broad. Fins D. narrow 8; C. 19, A. 1—10. V. little anterior to dorsal 9. P. narrow falcate 13, extending about half-way from their origin to that of the ventrals. Scales with radii stronger than concentric lines. From base of caudal to base of first dorsal ray, equal from latter to anterior border of iris. Lateral line deflexed, rising with outline of belly at anal fin. Above pale ochre, with a median brown line, and one on each side, from opercular upper angle to tail. Sides and below bright silvery, especially brilliant on the operculum and suborbital region. Lips blackish edged. Muzzle and chin whitish. Length three inches.

This species has but five scales above the lateral line as originally described, exceedingly rarely.

Three marked varieties of this species have come under my notice, as follows:

a. Depth greater, equal from end muzzle to middle of operculum; head usually 4.5 times in length. Numerous specimens from the Kanawha, especially from Sinking Creek and near Austinville, Wythe Co., Va.

aa. Depth less, six times in length, equal from end muzzle to edge preopercle; head four times in length. Two specimens from Youghiogheny, Pa.

aaa (P. l. engraulinus). Depth one-sixth of length, equal from end muzzle to between orbit and preoperculum, Head $3\frac{1}{2}$ times in length. One specimen from Austinville, Wythe Co., Va., from a tributary of the Kanawha.

PHOTOGENIS ARIOMMUS Cope.

Trans. Am. Philos. Soc. Phila. 1866, 280.

This species resembles at first sight the *Ph. leucops*, but is less elongate. On comparing an example of the latter, .25 longer, the depth of the body is the same, and the eye strikingly larger; the depth of the head the same, and the muzzle shorter.

In this fish the operculum is deeply concave on its upper posterior margin, and the inferior is shorter than the anterior; in *P. leucops* the former is straight, and the inferior border equal the anterior. The dark lateral line is faint or wanting in the *ariomus*, and there is no black vertebral band. Placed alongside of a *Hypsilepis cornutus* of equal length, this fish is less

[Dec.

deep, and has an eye of almost double the area, besides the different coloration and generic features of teeth and scales.

Eye two and three-fifths in length head; muzzle two-thirds its diameter; mouth large, mandible scarcely projecting, maxilla not attaining anterior margin of orbit. Frontal breadth three-fifths orbit. Pectoral fins reaching three-quarters distance to ventrals. Depth caudal peduncle one-third from middle origin caudal to opposite first anal ray. Basis of anal slightly elongate, four-fifths height of same, equal basis dorsal; latter equal two-thirds height of dorsal; last dorsal ray much less than half first, hence the outline of the fin is very oblique. Caudal deeply furcate, length equal that of head. Length from basis caudal to first dorsal ray equal from latter to above anterior part of orbit, as in *Ph. leucops*. Anal radii 1.9.

Light olivaceous sides and below silvery, becoming a band with superior dark edge on caudal peduncle. Sides of head and muzzle white.

Total length 2.875 inches; base of dorsal to superior base caudal 1.06 inches; same to end muzzle 1.19.

This species has only been found as yet in the White River, Indiana, by Wm. P. Clark, to whose attention I owe a single specimen.

PHOTOGENIS TELESCOPUS Cope, sp. nov.

A species combining an elongate form, short head and large eye, and nearly allied to the last described.

Mouth very oblique (angle 60°), mandible not projecting beyond premaxillary when closed; posterior margin maxillary on line of anterior margin of orbit. End of muzzle slightly decurved, profile above nearly plane; frontal region flat transversely, the parietal region gently convex in section. Lateral line slightly deflected. Posterior dorsal ray equal less than half the anterior, and equal the basis to the sixth ray. Basis of anal greater than that of dorsal, a little less than longest anal ray. Ventral fins fall short of vent, and are approached two-thirds the intervening distance by the pectorals. P. 14. D. and V. I. 8. C. \pm 19 \pm . Length of an average specimen 3 in. 6.5 lines; end muzzle to first anal ray 1 in. 11.5 lines; depth caudal peduncle at posterior anal ray 3.75 lines.

In life this species is a pale sea-green, with distinct brown edges to the scales. Lateral lustre plumbeous posteriorly.

This species is very abundant in all the rapid streams tributary to the Holston River in Virginia. It is very rare in the river itself.

PHOTOGENIS LEUCIODUS Cope, sp. nov.

This species is allied to the *P. telescopus*, and may readily be confounded with it, but the more delicate tints at once distinguish it in life, and the smaller orbit strikes the eye on making comparison. As shown in the analytic table, the characters are numerous. It is the only one of the genus adorned with bright colors; they are subdued, the purple and silver of the sides resembling the nacre of some *Uniones*.

Muzzle rounded in profile, mandible not projecting, mouth oblique (30°), end of maxillary bone opposite margin orbit. Vertex gently convex transversely. Twelve scales in vertebral line anterior to dorsal fin. Lateral line nearly straight. Radial formula, except for anal, and lengths of fins as in the last species. Longest dorsal ray measures twice from its origin to above posterior margin or middle of orbit. End of muzzle and basis of dorsal fin red, as in the young of *Hypseilepis coccogenis*.

Total length of a fully grown specimen 3 in. 1 line; length to first anal ray 1.8-5 lines. Depth caudal peduncle at last anal ray 3 lines.

This species is found in the tributaries of the Holston, in situations similar to those where the *P. telescopus* occurs. It is, compared with the last named, a rare fish. Numerous specimens in Mus. Academy.

PHOTOGENIS SPILOPTERUS Cope.

Trans. Amer. Philos. Soc. Phila. 1866, 280.

Form elongate, less so than in the *Ph. leucops*; scales with the radii distinct 6—10, and the concentric lines very strong. Lateral line deflexed anteriorly. Orbit three and one-half times in length of head, equal length muzzle, and is three-fourths the interorbital breadth. Head five and one-third times in total length, equal length caudal fin. Muzzle straight above, mandible not projecting when closed, end of maxillary attaining line of orbit. Premaxillary margin opposite middle pupil. Pectorals two-thirds length to ventrals. Bases of anal and dorsal fins equal, equal two-thirds height of former, three-fifths height of latter. First dorsal ray a little nearer origin caudal than end muzzle. Rays, D. 1.8. A. 1.8. V. 7 and 8. P. 13.

Length 2.875 inches, depth caudal peduncle at middle .19 in. Teeth in numerous specimens 1.4—4.1.

Color olivaceous, with a plumbeous band along the posterior half the lateral line; thoracic region and lower half the sides of head silvery, remainder of head blackish. Median part of caudal fin, a spot on the upper hinder portion of the dorsal, and a narrow vertebral line, black.

Many specimens of this species are in Museum Academy, from St. Josephs River, in southwestern Michigan.

This species bears a superficial resemblance to the *Hybopsis plumbeolus*, but apart from the difference of dentition, and the spot on the dorsal fin, this species has a smaller eye, longer ventrals, etc.

PHOTOGENIS SCABRICEPS Cope, sp. nov.

This species is readily distinguished from its congeners by its stout robust form, heavy head, and large eye, and in life by minute rugosities which cover the front muzzle and chin, but which disappear, leaving no trace, in spirits.

Front and vertex flat, upper profile plane, end of muzzle obliquely descending. Mouth little oblique, mandible as long as muzzle; extremity of maxillary opposite line of orbit. The operculum is more posteriorly prolonged than in the *P. telescopus*. Lateral line distinctly deflexed. Pins small, pectorals and ventrals short; radii as in the last species.

This species is not so refulgent as most others of the genus. In life it is of a bright sea-green, with an ill-defined silver lateral band, which is leaden shaded on the caudal peduncle. Dorsal streak reddish, scarcely perceptible in alcohol.

Total length 3 in. 1.5 lines; width of cranium behind 4.2 lines; length of caudal fin (equal from end muzzle to preoperculum) 5.75 lines.

This species occurs abundantly in the tributaries of the Kanawha River, in company with the *Ph. leucops*, especially in Sinking Creek, Walker's Creek, and near Austinville. It occurs not rarely in the main channel of the river also.

A Review of the species of the AMBLYSTOMIDÆ.

BY E. D. COPE.

This family is of particular interest among the Urodela, as furnishing connecting forms between the ordinary types of the order, and those larger species which we suppose to be more characteristic of former periods of the earth's history. It also furnishes us with transitional conditions of characters which have been regarded as indicating very diverse origin and nature. The species are mostly of large size, and are probably confined to North America; perhaps a species exists in Japan.

The characters which restrict the family are as follows:

Palatine bones not prolonged over parasphenoid, bearing teeth on their posterior margins.

[Dec.

Orbitosphenoid separated from proötic by membranous walls. Internal wall of vestibule membranous.

Carpus and tarsus ossified.

Vertebræ amphicælian

Prefrontals and pterygoids present.

Premaxillaries feebly developed, distinct, but not embracing a fontanelle.

Parasphenoid without dentigerous plates.

Parietals and prefrontals prolonged, embracing frontals.

The writer characterized the family as above in the Journal of the Academy, 1866, 105. Dr. Hallowell proposed it in the same work, 1858, 337, but on insufficient characters. Many of the characters of the principal genus, *Amblystoma*, had been already pointed out by Prof. Baird. The genera included by Hallowell were *Amblystoma*, *Xiphonura* Tsch., and *Onychodactylus* Tschudi. Gray had previously embraced the same genera with *Heterotriton* Gray, in his first section of the Plethodontidæ, which corresponds with this family. The writer in 1859 embraced *Onychodactylus*, *Amblystoma*, *Camarataxis* Cope, and *Megalobatrachus* Tschudi. In the above cited essay of 1866 the genera are limited to the two first mentioned, with *Ensatina* Gray.

The full investigation of the subject results in the following disposition of these supposed genera, Baird having already shown the identity of *Xiphonura* with *Amblystoma*. *Heterotriton* is identical with *Amblystoma*. *Megalobatrachus*, the great salamander of Japan, I have determined to pertain to the Protognathidæ. *Ensatina* Gray my friend St. George Mivart informs me is identical with *Heredia* Girard. If this be the case, it is established on a species of the Plethodontidæ, and one not to be separated from *Plethodon*. I therefore call *H. oregonensis* Girard, *Plethodon ensatus*, and thus we have three species* of this genus in the Pacific district, where none were previously supposed to exist. *Onychodactylus* most probably belongs to the Plethodontidæ, the sphenoidal teeth having been perhaps overlooked or lost; but it may be also an exceptional type of the same family. I have not seen it. The character from which it is named, and which has been regarded as part of its generic diagnosis, is probably only a seasonal or incidental one, and not likely to prove even specific. It is a common feature of the large *Amblystomæ*, and has no greater significance with them.

The genus *Camarataxis*, as will appear further on, was established on a larval character, permanent in some individuals, it is true, but not permanent in any species.

On the other hand, there is some probability that one or both of the species of *Hynobius* Tschudi, from Japan, enter the family, but this I am not able to establish.

It is important to observe the significance of the features defining this family. One only, of the eight assigned, is what may be termed a morphic character; the shortened form of the palatine bones, as compared with the posteriorly produced laminae of the Salamandridæ, being neither assumed after possession of the latter structure, nor identical with the immature stage of the same, so far as yet known. The two families do not appear, after the brief examination we have given this point, to be developmentally related. The presence of dentigerous plates on the parasphenoid in the Plethodontidæ is a character of the same kind.

The embracing of the frontals by the adjacent elements is a developmental feature, being characteristic of the larval condition of various families.

The membranous condition of portions of the walls of the cranium, including that of the vestibule, is a persistence of an immature stage of the Salamandridæ.

The biconcave vertebræ constitute a similar persistence of a larval feature.

* See description of *Plethodon intermedius* Baird, and *Plethodon croceator* Cope, from the West Coast, at the end of this paper.

The presence of pterygoids has the same significance with reference to other families.

The ossification of the carpus, tarsus, and of the premaxillaries, are characters in which this group develops beyond the larval condition which is permanent in the family of Plethodontidæ.

Thus of eight characters two are morphic, and six developmental; of the six, two are of advanced development, and four of repressed development, as compared with other families.

The characteristics of the genus *Amblystoma*, the only one of the family, are as follows:

Palatine series of teeth in the same line, though often interrupted.

Quadratojugal bone wanting.

Tongue attached by its whole base, but with a narrow free margin on all but the posterior portion.

Digits 4—5, free, not connected by natatory membrane.

A stratum of crypts more or less thickened on the parotoid region, and along the superior lateral region of the tail.

A series of mucous pores around the orbit, and for some distance anterior to it.

With respect to the caudal crypts, they are much less developed in the group of which *A. tenebrosus* Baird is the type than in the others.

The larvæ are characterized by the long slender processes of the three branchial laminae, which bear the vascular fimbriae, rather than the laminae themselves, as in some other genera. The internal nostrils are confined between the maxillary series of teeth and the palatine arch, which is concentric with the former and near to it, and is continued backwards on each side, in line with a similar series on the pterygoid bones. A relation of nostrils to palatine teeth similar to the above is permanent in *Amphiuma*, and one intermediate between it and the adult condition of *Amblystomæ* of groups III. and IV. characterizes *Protonopsis*.

The tail and back have a free dermal margin, but there is none on the limbs or digits. The tail is short and deep.

The general anatomy of the larvæ is reserved for the completion of this monograph.

The following are some of the most readily observed characters which are assumed by the *Amblystomæ* at the period of their transformation: 1, the series of teeth on the splenial bone is shed; 2, the carpus and tarsus ossify; 3, the tail narrows and lengthens; 4, the branchiæ disappear; 5, the tongue enlarges, and covers the floor of the mouth; 6, the pterygo-palatine series of teeth becomes more nearly transverse; 7, brightly colored pigment is deposited in the chromatophoræ of the derm. These changes are stated in the order of their occurrence. But in some of the protean species this order is not exactly observed in all individuals, and in consequence of the assumption of one or the other character of maturity in advance of another, the number of species has been supposed to be greater than it is. The same irregularity in the successional appearance of structures is well known in the earlier periods of embryonic life, as stated by Von Baer in the Scholia of his *Entwicklungsgeschichte*. In the chick, different portions of the vertebral axis, and the abdominal plates, may or may not appear in the usual order or succession.

In *Amblystoma* the approximation of the period of reproduction to that of transformation varies with the species, and it is evident that, the closer this approximation under the above principle of variation, the more protean will the species be. As we know from the experiments of Hogg, Duméril and others that metamorphosis is greatly hastened or delayed by the conditions of temperature and light, what would not be the effect, on individuals of such a protean species, of a change of topographical situation, such as the elevation or depression of the land? And I have no hesitation in saying that if the peculiarities of series of individuals of *A. tigrinum* and *A. mavortium*, in the

[Dec.

respects above enumerated, were permanent, they would characterize those series as species, as completely as any that zoologists are accustomed to recognize. For the evidences on this head, see the discussions of those species below.

The experiments of Hogg above alluded to are as follows, as given by him in the *Annals and Magazine of Natural History*.

He placed a number of impregnated ova of frogs in vessels arranged at regular distances from the light, in a cave. The lessening degrees of light were of course accompanied by a corresponding, but much less rapid decline in temperature. The resulting effects on the metamorphosis may be tabulated as follows :

| | | Mean Fahr. | | | |
|-----|------|-------------------|---------------|---------------|---------------|
| Mo. | Day. | 60° | 56° | 53° | 51° |
| 3 | 11 | Egg | Egg | Egg | Egg |
| | 20 | Larva free. | * | * | * |
| | 25 | * | Larva free. | * | * |
| | 31 | * | * | Larva free. | Larva free. |
| 4 | 10 | Larva very large. | * | * | * |
| | 22 | Metam. complete. | Larva large. | Larva large. | Larva small. |
| 8 | 11 | | Metam. compl. | * | * |
| | 28 | | | Metam. compl. | * |
| 10 | 31 | | | | Metam. compl. |

Other experiments, which will not be quoted now, are equally conclusive as to the effect of light and heat on this process.

The distinction between maturity, or adult age, and complete development, must be borne in mind. The former condition is attained when the ova are fitted for impregnation, and the spermatozooids are capable of accomplishing that result. Development may or may not advance much beyond this period. As one or more periods in the life of every species is characterized by a greater rapidity of development (or metamorphosis) than the remainder, so in proportion to the approximation of such a period to the epoch of maturity or reproduction, is the offspring liable to variation.

The great difference between the different species, and between individuals of the same species in this respect, may be illustrated by the following comparison between the size of the animals at the time of losing the branchiæ, so far as known, and that to which they ultimately attained :

| Species. | Size at loss of branchiæ. | | Average full size. | |
|--------------------------------|---------------------------|----------------------|--------------------|--------|
| | In. | Lines. | In. | Lines. |
| <i>A. jeffersonianum</i> | 1 | 5.75 | 6 | |
| <i>A. punctatum</i> | 1 | 10 | 6 | 6 |
| <i>A. conspersum</i> | 1 | 10.5 | 2 | 7.5 |
| <i>A. opacum</i> | 2 | 2 | 3 | 9.5 |
| <i>A. texense</i> | 2 | 1 | ? | |
| <i>A. microstomum</i> | 2 | 3.5 | 4 | |
| <i>A. talpoideum</i> | 3 | (perhaps too large). | 3 | 9.5 |
| <i>A. paroticum</i> | 3 | 7.5 (not smallest). | 7 | 2.5 |
| <i>A. tigrinum</i> | } 3 6 3 | 7 to | 8 to 10 | |
| | | 7 | | |
| | | 9.5 to | | |
| <i>A. mavortium</i> | 8 | | 8 | 9 |

In this connection it is desirable to ascertain how far characters distinguishing undoubted species fall into the line of successional changes common to all the species. An answer to this question would solve an important part of the inquiry as to the origin of species. We cannot go into it exhaustively at this time, but direct attention to these characters in the synoptic table. The following are developmental characters which distinguish known species : 1, the direction of the palatine series of teeth ; 2, the length of the body and tail, as 1867.]

compared with the width of the head, is greater in large and old individuals of *A. tigrinum*; 3, the widening of the muzzle and greater separation of the external nares; 4, the spotted, as distinguished from the uniform coloration.

Characters to which no such relation can be assigned: 1, the number of costal folds, whose interspaces correspond with the vertebræ; 2, the number of phalanges.

The complete monography of this genus being reserved for another occasion, the description of the *Siredons* is not now attempted. Suffice it to say that both Prof. Baird and myself have had evidence, for some time, that some species described by Prof. B. under this name, from our south-western regions, are only undeveloped *Amblystomæ*; and Prof. Duméril, in the *Jardin des Plantes*, has actually observed the complete metamorphosis of a Mexican species.*

In the following pages little more than a review of the species is attempted. Their clear discrimination has been hitherto a desideratum. Baird, in the first synopsis published, enumerates eight; Gray in 1850 catalogues ten, after we exclude some species of other genera erroneously included. Duméril likewise, including species of other genera, gives five true *Amblystomæ*. Hallowell, 1858, increased the number to sixteen. In the present essay, the species of the family described number nineteen, seven new ones being added. I must here express my acknowledgements to Prof. Baird, who has placed his MSS. notes at my disposal, and which I have adopted whenever they expressed the results of my own observations. Thus the diagnoses of nine of the species, and portions of those of two others, are, with certain modifications, from his pen. The materials on which the essay is based are the unequalled collections of the Smithsonian Institution, which goes beyond all others in the department of Urodela. Probably the second best collection existing, that of the Academy, has also furnished its numerous types, and many little known species, mostly described by the late Dr. Edw. Hallowell.

After the following examination of the transitional features of the species, the value of many of the supposed species heretofore described will be better estimated.

Synopsis of species.

- I. Series of teeth along the external fissure of the internal nares. Plicæ of tongue radiating from its posterior portion. Parotoid glands not forming an ovoid distinct mass. Four phalanges in fourth toe.†

A. Costal grooves ten;

α. Vomerine series three.

Head broad, width 3·5 to groin; muzzle contracted. External nares much closer than internal; palatine series convex backwards; tail short, compressed; blackish-brown, grey speckled..... talpoideum.

B. Costal grooves eleven.

α. Vomerine series three.

β. No, or one indistinct plantar tubercle.

Middle series transverse or concave behind posterior margins of nares; width of head in specimens of three inches greater than one-fourth length to groin, in adult, 4·7 times; black above, with gray fasciæ; larger..... opacum.

Teeth as in the last; width of head in small specimens 3·5 to groin, in adults 4·5 times; a strong dorsal groove and longer tail; black above, with a series of round yellow spots on each side the back..... punctatum.

* See a highly interesting account of this event by Prof. Duméril, *Annales des Sciences Naturelles* for 1867, No. iv. p. 229.

† Vide an exception under *A. mavortium* Bd.

Median series of teeth convex, advancing beyond posterior margin nares; width of head much less than one-fourth length to groin; tail short, no dorsal groove; lead colored, with an inferior lateral, and usually superior series of small yellowish spots..... conspersum.

ββ. Two distinct plantar tubercles.

Median series of teeth straight, nearly divided; external nares much closer together than internal; width of head more than one-fourth length to groin; muzzle very short; tail much compressed; blackish above, with large irregular yellow spots, confluent on sides; below yellow..... bicolor.

C. Costal grooves twelve; mucous pores on each side the muzzle.

a. Larger species with two distinct plantar tubercles.

β. No canthus rostralis; head longer.

External nares as widely separated as inner; frontal and nasal regions very convex in transverse section; teeth in four distinct series, forming together a V, with concave sides projecting between the nares; body long, tail short; color brown..... obscurum.

External nares nearer together than internal, on account of narrower muzzle; brown, with usually small yellow spots; brown always predominating; teeth continuous, or slightly interrupted externally..... tigrinum.

External nares as widely separated as internal; the muzzle broad obtuse; brown yellow spotted, the yellow spots large, often excluding the ground color; teeth continuous, or slightly interrupted externally..... mavortium.

External nares as widely separated as inner; the muzzle broad obtuse; dark brown, with vertical yellow spots on sides; teeth in four distinct series, in a nearly transverse line..... trisruptum.

ββ. Canthus rostralis distinct; tail longer than head and body. Head shorter.

External nares nearer together than internal; muzzle obtuse, head small, width five times to groin; front convex; vomerine teeth in one series slightly convex forwards; yellow, with irregular brown bands above..... xiphias.

αα. Smaller species. Teeth in three series. No or one indistinct plantar tubercles.

External and internal nares equidistant; width of head 4.5 to 5 times in length to groin; length of eye 2.5, or a little less in width between anterior canthus of same; tooth series transverse; lead-colored to black, with or without pale or distinct lateral spots..... jeffersonianum.

Inner and outer nares equidistant; width of the long oval head 5.5 to 6 times in length to groin; length eye fissure 1.75 (to? twice) in width between anterior canthus of same; tooth series slightly convex; lead-colored, uniform..... platinenum.

Nares equidistant; width of head 5 times to groin; muzzle contracted; eye fissure 1.66 between anterior canthus of same, once to nostril; median dental series convex forwards. A broad grey band on vertebral line of tail and body, expanding on occiput; sides dark reddish-brown..... macrodactylum

II. Series of teeth extending to external fissure of inner nares; lingual plicæ radiating from behind; parotoid glands forming a distinct ovoid mass.

- α. Teeth in three series (no canthus rostralis or plantar tubercles); fourth toe with three phalanges.
 Nares equidistant, both approximated; median series of teeth nearly straight, short; width head 4.5 times to groin; eye fissure 1.7 times in width between anterior canthus; limbs large, toes short. Uniform brown..... paroticum.
- III. Series of teeth not extending beyond inner line of nares; lingual plicæ radiating from behind; no distinct parotoid mass.
 α. Two series of teeth (canthus rostralis distinct); no plantar tubercles; fourth toe with three phalanges; twelve costal furrows (species large).
 Vomerine series transverse or directed backwards; muzzle prolonged considerably beyond nares; brown, marbled with dark brown tenebrosus.
 Vomerine teeth in two sigmoids, which converge in advance of nares; muzzle shortly rounded from external nares; uniform black..... aterrimus.
 αα. Two series of teeth; fourteen costal grooves; fourth digit with four phalanges.
 Teeth arched, between inner nares; head one-fourth to groin (in small sp.); eye one-half width between canthus; muzzle broad, outer nearer than inner nares; brown, with a series of lighter spots on upper part of sides; below yellowish; muzzle and tail marbled with the same..... texanus.
- IV. Series of teeth not extending beyond inner margin of nares; lingual plicæ radiating from a median longitudinal furrow of the tongue; no distinct parotoid mass (species small).
 α. Two series of teeth (no canthus rostralis); fourth toe with four phalanges.
 Mandible shorter than muzzle; head elongate, width between eyes behind equal from same to nares; width of head 6.5 times in length to groin; black, with numerous narrow grey annuli on body and tail..... cingulatus.
 Mandible longer than muzzle; head short, broad; width between eyes behind equal from same to end muzzle; body stouter; width of head $6\frac{1}{2}$ to 7 times in length to groin; lead-colored, with a few grey shades below..... microstomus.

AMBLYSTOMA TALPOIDEUM Gray.

Catal. Batr. Grad. Brit. Mus.; Hallowell, J. A. N. Sc. Phil. iii. 351; Baird (?) l. c. i. 288. *Salamandra talpoidea* Holbrook, N. Amer. Herpetology, iii. 117, pl. 29, 1838.

Shortest, stoutest, and most clumsily formed of all the terrestrial *Amblystomata*. Character of skin, as to glands, pits, etc., much as in *A. punctatum* and *opacum*. A row of large pores on the head, interior to the eye and nostrils, extending anterior to the latter; this passes behind and beneath the eye, reaching forward nearly to the nostrils. A patch on the cheeks above the lateral groove, and another below it, probably extending forward along the lower jaw.

The head is very broad, and larger, if anything, wider, than the body; becoming constricted at the neck. Its width is about equal to the distance from snout to gular fold (thus wider than long), and contained about $3\frac{1}{2}$ times to the groin. The eyes are superior, and rather small; separated anteriorly by nearly three lengths of the orbit, about one orbit from the nostrils, which are separated about $1\frac{1}{2}$ orbits. The muzzle is rather angular. The upper jaw is visible beyond the lower, when viewed from below.

[Dec.

The body is short, squat and depressed; there are ten costal grooves on the side.

The tail is contained about $1\frac{1}{2}$ times in the rest of the animal. It is much as in *A. opacum*, but higher, though without a crest.

The digits are rather long and slender, scarcely different from those of *A. opacum*.

The palatine teeth are in a transverse series of three sections. The middle section is not interrupted along the median line. In the type it is slightly concave anteriorly, scarcely reaching to the under line of the inner nares, and behind the range of the lateral sections, which begin a little interior to the outer line of the nostrils. The middle and lateral sections are separated by the width of the inner nostril. In another specimen the middle patch is nearly straight, in another composed of two arcs concave anteriorly.

The tongue is thick, fleshy and adherent, though the edges are free at the sides; less so at the top. Its width is not more than half that of the head. The papillose portion is separated posteriorly by the extension forward of the plain basal portion of the tongue, although there is no groove, and exhibiting two prominent cornua to the tongue proper. The papillose ridges are longitudinal, and nearly parallel.

In alcohol this species is a light brown above, paler beneath, irregularly sprinkled, blotched and marbled with silvery or plumbeous gray of a lichen-like character. A carefully executed drawing, made from the specimens when alive, shows the ground color to be a dark brownish or liver black, more livid on the sides, and perhaps lighter beneath; everywhere sprinkled with the silvery-grey dots, of larger size, on the back. The upper part of the tail is of a purer brown than elsewhere, and is bordered by a series of obscure blackish spots, seen also near the lower margin; a few similar dusky spots appear scattered on the back. The iris appears to be a dark brown, without metallic lustre.

A series of specimens from Prairie Mer Rouge, La., is quite similar. Some of these appear to have just completed the change from the tadpole state, and the tail is higher, more compressed, and somewhat crested; the toes shorter and flatter; the papillose cornua of the tongue more indistinct.

| | |
|--|-----|
| Length from snout to transverse line of mouth..... | 30 |
| “ “ gular fold..... | 55 |
| “ “ groin..... | 190 |
| “ “ behind anus..... | 230 |
| “ “ end of tail..... | 380 |
| “ of tail..... | 150 |
| Width of head..... | 52 |
| Length fore arm..... | 46 |
| “ hind leg from knee..... | 56 |
| Extent of hind legs..... | 170 |
| Greatest height of tail..... | 31 |
| “ width at same place..... | 15 |

| Catalogue No. | No. of Spec. | Locality. | From whom received. |
|---------------|--------------|-------------------------|----------------------|
| 3906. | 5 | Liberty Co., Ga., | Dr. Jones, sp. desc. |
| 3879. | 6 | Prairie Mer Rouge, La., | J. Fairie. |
| 3972. | 1 | Near Cairo, Ill., | R. Kennicott. |

AMELYSTOMA OPACUM Baird.

J. A. N. Sci. Phila., i. 283; Hallowell, l. c., iii. 351. *Salamandra opaca* Gravenhorst, Uebersicht Zool. Syst. 431, 1807; Delic. Mus. Vratislav. i. 75, tab. x. 1829. *S. fasciata* Green, J. A. N. S. i. 350, 1818; Holbrook, N. Amer. Herpetology; Storer, Mass. Rept.; Dekay, Geol. Surv. N. York.

Body swollen, thick, cylindrical, depressed. Skin perfectly smooth, although under a lens everywhere showing minute simple pores or pits connected with 1867.]

the glands, which are seen everywhere in the body and tail, except perhaps in the lower part of sides, belly, and beneath the head; on the tail, however, they are more developed on the upper half. There are no regular patches of more conspicuous pores on the head and parotids, as seen in *A. punctatum*.

Head rather broad, depressed; its greatest width about three-fourths the length from snout to gular fold, and about two-ninths the distance to insertion of hind legs. Length of mouth half that to gular fold, which is interrupted on the nape. A constriction behind the angle of the mouth, with a lateral groove (or ridge) connecting the two, as in *punctatum*. Distance from snout to gular fold not quite three and a half times in that to insertion of hind leg. The eyes are moderate; the pupil circular. The general relation much as in *punctatum*.

Body nearly cylindrical, but decidedly depressed. No indication of a dorsal furrow. Eleven well-marked costal furrows, including the inguinal. There are about four pelvic furrows; those on the base of the tail are distinct for a time, but gradually become fainter.

The tail is oval or elliptical in cross section, though without any indication of a keel. It is nearly cylindrical at base, though slightly compressed; becoming more and more so to the pointed tip. It is thicker above than below, and, measured from beneath the anus, is contained one and a half times in rest of the length. The lateral groove on the tail is less prominent than in *A. punctatum*.

The digits are linear, depressed, but without any indication of web or margin. The third or longest finger is one-third the distance from its tip to the elbow (contained three times); the lateral ones are quite short. The fourth toe is longest; contained two and a half times in the distance from its tip to the knee. The third, fifth, second and first are successively shorter, or the fifth and second are about equal. The distance between the outstretched toes is contained about once and two-sevenths the length from snout to behind anus.

The tongue is thick and fleshy, as in *A. punctatum*, though larger in proportion, and filling the mouth more. The teeth are in one transverse line, in three series, much as in *punctatum*. The central is a double arc. The lateral series are not so far forward, or pass more obliquely backwards, so that their exterior end is even behind the convexity of the central series, not anterior to it. The lateral series is about half the length of the central, with a decided interval.

In alcohol the general color is a livid black. There is a dorsal series of transverse slate-colored bands, which widen at each end into a V on the back, but are more linear on the tail. These vary in number; about seven on the body, and as many on the tail. Sometimes more or less: sometimes confluent with those before and behind them; sometimes interrupted in the middle. They do not descend one-third the depth on the sides, being confined abruptly, and well defined to the dorsal region. There is a similar patch on the snout.

| | | | |
|----------------------|------|------------------------|------|
| Total length..... | 3.80 | Length to tail..... | 2.35 |
| Length of mouth..... | .30 | “ of tail..... | 1.50 |
| “ to gular fold..... | .53 | Width of head..... | .45 |
| “ to fore leg..... | .60 | Length from elbow..... | .45 |
| “ to hind leg..... | 1.90 | “ “ knee..... | .55 |

The principal difference in form and structure between this species and *A. punctatum* are seen in the absence of any dorsal furrow, and a less prominence of that on the side of the tail. The limbs are more feeble, the head narrower, the tail shorter, etc.

In specimens from Prairie Mer Rouge, 4033? the body is thicker and more clumsy, the legs weaker, the toes shorter, than in Pennsylvania specimens. The teeth, too, appear more transverse, and there is little or no interval between the middle and lateral combs.

[Dec.

| Cat. No. | No. of spec. | Locality. | From whom rec'd. | Type of desc. |
|----------|--------------|-----------------------------------|-------------------|---------------|
| 3932 | 15 | Carlisle, Pa. | S. F. Baird. | |
| 3940 | 1 | Kemper Co, Miss. | D. C. Lloyd. | Type of desc. |
| 4100 | 16 | South Illinois. | R. Kennicott. | |
| 3948 | 1 | Tarboro, N. C. | Brigder. | |
| 3943 | 1 | Meadville, Pa. | Thickstun. | |
| 3964 | 1 | Racine, Wis. | | |
| 3924 | 6 | Georgia. | Dr. Le Conte. | |
| 3958 | 1 | Aux Plaines R., W. Northfd., Ill. | R. Kennicott. | |
| 4008 | 2 | Columbus, Ga. | Dr. Gessner. | |
| 3928 | 1 | Anderson, S. C. | Mrs. Daniel. | |
| 3927 | 14 | Gloucester, Va. | | |
| 3962 | 1 | Ripley, O. | P. Hoy. | |
| 3941 | 1 | Abbeville, S. C. | J. B. Barrett. | |
| 4085 | 10 | Grand Coteau, La. | St. Charles Coll. | |
| 3954 | 4 | Galveston, Texas. | E. B. Andrew. | |
| 3953 | 1 | Salem, N. C. | J. T. Lineback. | |
| | 3 | Georgia. | Maj. Le Conte. | |
| 4007 | 116 | Prairie Mer Rouge, La. | Jas. Fairie. | |
| 4920 | 1 | Florida. | Townend Glover. | |
| 4018 | 1 | New Orleans. | N. O. Acad. N. S. | |
| | 1 | Pearl R., Miss. | R. Kennicott. | |

AMBLYSTOMA PUNCTATUM, Baird.

J. Ac. Nat. Sc. Phil. i. 83. Hallowell, L. c. iii. 351. *Lacerta punctata* (1767), L. Syst. Nat. ed. 13, 370, 45. *Salamandra p.* (1802) Lacep. Hist. Quad. Ov. i. 245, 314 (ed. of 1819). *L. maculata* (1802), Shaw, Gen. Zool. Amph. 304. *Salamandra venenosa* (1803?), Bart. in Daud. Hist. Rept. viii. 229 (in lett. from Raf.) *Lacerta subviolacea* (1809), Bart. Am. Phil. Trans. O. S. vi. p. 108, pl. 4 fig. vi. *S. subv.*, DeKay (1842), N. Y. Rept. 74, pl. 2, f. 36. *S. venenosa* (1838), Holb. Herp. 1st ed. iii. 105, pl. 24 (1842), 2d ed. v. 67, pl. 22. *Amblystoma subviolaceum*, Tschudi.

Body swollen, stout, cylindrical. Head depressed. Skin smooth though pitted with pores, most numerous on the tail. Of these there is a patch larger over on the parotid region, and another on the top of the head inside of the orbit and extending anteriorly in a straight line towards the nostrils, and passing backwards semicircularly behind the eye; a double row round the edge of the lower jaw; a pair on each intercostal space along the side of the body, and a row on each side of the top of the tail; the latter indicated generally by a whitish dot.

Head broad, depressed; width nearly equal to distance from snout to gular fold, and nearly one-fourth the distance to insertion of hind legs. Length of mouth, along axis of body, nearly distance from snout to gular fold, which is nearly continuous across the nape. There is a convolution behind the angle of the jaws, interrupted above and below, and a furrow connecting the two along the parotid region, and extended in a lateral line to the orbit. Distance from snout to gular fold contained $3\frac{1}{2}$ times in distance to insertion of hind lip; (four times in another specimen).

The eyes are moderately large; the length of the orbit contained $4\frac{1}{2}$ times in distance from snout to gular fold; about once in distance from the nostrils and about once in the distance between the two nostrils; nearly twice in distance between the anterior extremities of the orbits.

Body nearly cylindrical; perhaps slightly depressed, and swollen a little in the middle. On each side are eleven costal grooves, including unguinal and axillary ones, strongly marked, and nearly continuous above and below. The axillary is, however, quite inconspicuous. Four more of these furrows to behind the anus, where the last is confluent with the first caudal furrow.

1867.]

These become less and less distinct to near the middle of the tail. There is a slight groove down the middle of the back.

The tail is oval in section, the larger end of the oval below; becoming more and more compressed to the tip, without indication of any ridge. There is a lateral indentation along the whole length, which is about equal to the distance from its back to the snout. In alcoholic specimens the tail is bent or curved, sometimes upwards, sometimes down, sometimes laterally.

The digits are nearly cylindrical, or slightly depressed, without web or margin. The third or longest finger is contained about $2\frac{1}{2}$ times in the distance to the elbow. The second finger reaches to the last articulation; the fourth to the penultimate.

The fourth toe is largest, contained $2\frac{1}{2}$ times in the distance to the knee; the 3d, 2d, 5th and 1st successively shorter. The distance between the outstretched hind toes is rather more than one and one-third the length to behind anus.

The tongue is thick, fleshy and attached, although free at the edges, except behind. It is about two-thirds the width of the upper jaw, nearly orbicular, though the outline of the papillose portion is a little emarginate behind. It almost seems as if the tongue were capable of closing round an object in its centre as in the hollow of the hand.

The transverse line of teeth is in the parts or combs; a central about two-fifths the width of the head, and separated from the lateral by a slight interval. The central patch is nearly straight in its middle, but the end curves a little forwards, and continuously with the lateral portion of the line, from a curve concave backwards, bounding the orbit. The inner edge of the posterior nares marks the extent of the central row of teeth. The lateral combs of teeth are about half the central.

The color of the specimen described is, in alcohol, of a dark liver brown above, abruptly light olivaceous beneath. On each side of the back is a series of nearly circular rounded spots, about the size of the orbit; about three on each side of the head, 8 or 9 on the body, and as many on the tail, where they are sometimes confluent. These spots are white in alcohol, but yellow in life. Along the sides, and more sparingly beneath, are some scattered quite small whitish spots, not very conspicuous. The legs are of the color of the under parts, not of the upper. They show some of the small light spots seen on the sides.

| | | | |
|-------------------------------|------|-------------------------|------|
| Total length of 3950 (1)..... | 6.50 | Tail, behind anus..... | 3.10 |
| “ mouth..... | .40 | Width of head..... | .65 |
| “ to gular fold..... | .82 | Arm from elbow..... | .60 |
| “ groin..... | 2.80 | Hind leg from knee..... | .80 |
| “ behind anus... .. | 3.40 | | |


In the preceding paragraph I have described a specimen from Abbeville, S. C., as a locality nearest to that whence the original of Linnæus' description was obtained. An examination of a large series of specimens from different localities shows certain differences which, however, are not of a character to indicate specific separation. Carlisle specimens have longer and more cylindrical toes than those from Louisiana.

The external appearance of the skin varies considerably with the strength of alcohol used for preservation, and probably with the season when captured. The animal when alive is perfectly smooth and lustrous, and readily exudes a large quantity of a white milky juice from the upper half of head, body and tail, or from the dark colored portion. This is due to the presence of glands closely implanted in the skin, the pores of which are sometimes quite inconspicuous, sometimes very distinct. On the tail they are much largest and deepest, and the lateral groove marks their inferior boundary, being there implanted vertically. When these pores are very full of their milky juice, and the alcohol is very strong, the contraction of the skin between the mouths of these pores gives more or less the appearance of rounded, thick-set granules,

[Des.

of rather large size. This also gives rise to an apparent depression of the digits, the skin forming quite a margin.

The proportions of the body vary slightly. The tail is generally not so long as the rest of the animal, the groin being more usually nearer the middle point of the axis. Younger specimens appear to have shorter tails.

There is considerable diversity in the curve of the transverse series of palatine teeth. In nearly all more northern specimens the central row is formed of two arcs, concave anteriorly , more or less continuous with the lateral, which are anterior and convex anteriorly. The two central arcs are continuous at their inner ends, forming an inverted angle at the axial line. Sometimes, however, as in most of the specimens from Prairie Mer Rouge, this central angle is wanting, and there is only a single arc or curve, concave anteriorly. In the type specimen described the central row of teeth is nearly or quite straight (which is quite apt to be the case in very large ones), while in one specimen of No. 4684 it is convex anteriorly. The transverse extent of this middle line of teeth varies. Sometimes there is quite an interval between it and the lateral, while in 3930, from New York, they are continuous, without appreciable interruption.

There are no very great variations in the pattern of coloration; generally the outer surface of the limbs is colored like the back, in which case there are one or more large rounded light spots. The under parts are generally dark-bluish; the sprinkling of small white specks on the sides and beneath varies considerably in prominence. The large dorsal spots are always nearly circular, and vary in number; generally only one series on each side.

In living specimens from Carlisle, Pa., the iris is dark brown, without metallic color, scarcely distinguishable from the pupil. The color of the animal above is a deep anthracite black, beneath dull livid. On each side the dorsal line is a series of large, nearly circular, gamboge yellow spots, somewhat symmetrically disposed. These vary from 10 to 20 from head to tail, and sometimes are larger than the eye, usually about its size. On the sides and beneath are sparingly scattered small bluish-white specks. The spots, both yellow and bluish-white, are sometimes found on the legs.

In younger individuals the yellow spots are brighter, and the black ground deeper.

| Cat. No. | No. of Spec. | Locality. | From whom received. |
|----------|--------------|-------------------------------|------------------------------|
| 3950 | 6 ♂ | Abbeville, S. C. | J. B. Barrett (spec. descr.) |
| 3936 | 1 | Quebec. | R. Nettle. |
| 4084 | 2 | Grand Coteau, La. | St. Charles Coll. |
| 3925 | 2 | St. Louis, Mo. | Dr. G. Engelman. |
| | 2 | Lake Superior. | J. H. Slack. |
| 3944 | 1 | Centre Co., Penn. | S. Brugger. |
| 3961 | 3 | Somerville, N. Y. | |
| 3938 | 7 | Root River, Racine, Wis. | Prof. Baird. |
| 4686 | 1 | Cleveland, O. | Dr. Kirtland. |
| 3963 | 6 | Meadville, Pa. | |
| | 1 | Halifax, N. S. | Dr. Gilper. |
| 4077 | 2 | Fort Towson, Red R., Ark. | Dr. L. A. Edwards. |
| 3942 | 3 | Knoxville, Tenn. | Prof. Mitchell. |
| 3929 | 2 | Westport, N. Y. | S. F. Baird. |
| 3930 | 2 | Alleghany Co., N. Y. | Dr. Stevens. |
| 3926 | 6 | Carlisle, Pa. | Prof. S. F. Baird. |
| 4086 | 2 | Virginia. | W. McDonnald. |
| 3786 | 1 | Cleveland, Ohio. | Dr. Kirtland. |
| 3905 | 62 | Prairie Mer-Rouge, La. | Jas. Fairie. |
| 4098 | 41 | W. Northfield, Cook Co., Ill. | R. Kennicott. |

AMBLYSTOMA CONSPERSUM Cope.

Proceed. Acad. Nat. Sci. Phila. 1859, 123.

This is one of the smallest species of the genus, and though less stout than 1867.]

the two preceding, is more so than the *A. jeffersonianum*, which it resembles in general features.

Skin everywhere smooth. In some specimens only a series of pores may be traced along the superciliary region, and in a line to near the nostrils: several are on the parotoid region. The skin of the body is remarkably free from visible pores, while, as usual, the superior part of the tail is thickly studded with them.

The head is a broad oval, its width entering the length to the groin 4.5 times or a little more, and is a little over three-fourths distance to gular fold. Eye fissure equal to nostril and 1.75 between anterior angles, and a little more than distance between nostrils. The last distance is a little less than that between inner nares. Posterior canthus of eye a little anterior to canthus oris, anterior canthus opposite middle of upper lip from anterior point. Muzzle longer than chin.

Furrows behind the orbit inconspicuous, but present. Costal grooves eleven. Tail short, everywhere compressed, measuring from its origin (at end vent) to axilla or to gular fold. No marked dorsal groove.

The limbs are short, the digits long and slender. When appressed the fingers reach to the keel or beyond bases of fingers. Digits subcylindrical, anteriorly 3d longest, then 2, 4, 1; posteriorly 4, 3, 2, 5, 1. Two small tubercles on edges of sole. Expanse of outer toes equal from end muzzle to posterior canthus eye.

Teeth in three patches, the median longest, commencing opposite inner margin nares and convex to between nares or nearly so in one specimen. Tongue longer than broad, the laminar portion prolonged in two lateral bands posteriorly.

| | Lines. |
|--------------------------------------|--------|
| Length from snout to gular fold..... | 47.0 |
| “ “ groin..... | 16.25 |
| “ “ end anus..... | 19.3 |
| “ “ end tail..... | 31.9 |
| “ of mouth on median line..... | 3. |
| “ fore arm and hand from elbow | 3. |
| “ leg and foot from knee. | 5. |
| Width of head..... | 3.7 |

General color above leaden, below pale leaden, the latter usually bounded by the line of the limbs, but in one specimen rising as high as the line of the eye. Lower parts of sides and sides of tail more or less varied with small whitish spots, the former often in a regular line. A similar line on the upper part of the sides is present in some specimens, in others wanting. The end of the muzzle is sometimes pale marbled.

Eight specimens of this species before me confirm its validity in every respect. Specimens of the developed young of both *A. opacum* and *A. punctatum* are of considerably smaller size, and maintain their peculiar colorations, and a greater width of the head, etc.

From the appended localities from which it has been sent, the range is seen to be extensive:

| No. | No. Spec. | <i>Mus. Smithsonian.</i> Locality. | Donors. |
|----------------|-----------|---------------------------------------|----------------|
| 3934 | 3 | Carlisle, Pa. | S. F. Baird. |
| 3918 | 1 | “ | “ |
| | | <i>Mus. Academy.</i> | |
| | 1 | Charleston, S. C. | Dr. Hallowell. |
| (Spec. descr.) | 2 | Liberty Co., Ga. | John Le Conte. |
| (Type) | 1 | Chester Co., Pa. | E. D. Cope. |

AMBLYSTOMA BICOLOR, Hallowell.

Proceedings Acad. Nat. Sci. 1857, 215.

In the type specimen of this species, the usual supraorbital and lateral
[Dec.

frontal series of large pores are not discernible. In a second specimen they are well marked. In the former the skin is quite smooth, with eleven lateral grooves, and the folds of the throat and side of the head not strongly marked. The head is broad and obtuse, entering the length to the groin 3.75 times. The front convex is profile, containing the length of the fissure of the eye in its width between anterior canthus of same 2.75 times. The same measure is a trifle less than distance from same to nostril, and one and a quarter the distance between the latter. These are much closer together than the inner nares. Distance between outer margin of nares equal length from end muzzle to mid-interorbital space.

Dorsal line with a faint groove. Tail much compressed, equal from end vent to canthus oris. Body stout and heavy. The limbs are stout and the digits not elongate and depressed. The appressed limbs overlap by the length of the toes. Two well marked palmar tubercles. Third and fourth toes nearly equal, fifth a little longer than first.

Tongue large, disciform, not emarginate behind; palatine teeth in three entirely transverse series, the interruption taking place considerably inside the line of the nares. The teeth themselves are in numerous rows on each of their bony crests, presenting a brush-like arrangement. Medium series notched behind.

| | In. | Lines. |
|---|-----|--------|
| Length from end muzzle to gular fold..... | | 9.75 |
| “ “ to groin..... | 2 | 7.2 |
| “ “ to end vent..... | 3 | 2.3 |
| “ “ to end tail..... | 5 | 10.05 |
| “ of mouth (straight)..... | | 6.1 |
| “ forearm and foot..... | | 6.75 |
| “ lower leg and foot..... | | 8.8 |
| Width of head..... | | 8.75 |

Color above olive brown, below yellowish, olive shaded in the middle. The inferior yellow rises on the sides as short blotches; above them are several ill-defined yellowish spots. Parotoid region yellow, with a distinct black vertical bar. Limbs brown cross banded; tail yellow with brown spots.

The above description is taken from the type from Beesley's Point, N. Jersey, in Mus. Academy. Another specimen, 4692, from the same locality, in Mus. Smithsonian, differs in two important particulars; the palatine teeth are not brush-like, but are confined to the crest of the ridge, and the tail is a little longer than the head and body. The muzzle is rather longer and the mucous pores more numerous. It may belong to another species, as the *A. tigrinum*, which it much resembles, but its eleven costal folds are a notable peculiarity. The *A. bicolor*, though nearest the *tigrinum*, appears distinct, after a careful scrutiny of many individuals of the latter.

AMBLYSTOMA TIGRINUM, Baird.

Journ. Ac. Nat. Sci., Phila., i. 284. *Salamandra tigrina* Green, v. 116, 1825. *Triton tigrinus* Holb., N. Amer. Herp. 1842, 579, DeKay, Nat. Hist. New York. *Salamandra lurida* Sager, Am. Journ. A. S. 1839, 322. *Amblystoma luridum* Baird, J. A. N. S. i. 284, Hallowell, l. c. iii. 383. *Amblystoma episcopus* Baird, l. c. 292, Hallowell, J. A. N. S. iii. 354. *Salamandra ingens* Green, l. c. 1831, 254. *Amblystoma* Hallow. *Heterotriton* Gray.

General form very thick and massive, although the head is proportionally small in mature specimens; not as broad as the body. The skin appears quite smooth when fresh, especially when covered with its epidermis. On removing this, however, the skin is seen everywhere closely covered with shallow pits, interspersed with granule-like projections of the glands. There is an indistinct line of pores on each side of the head interior to the eye, but they can scarcely be traced elsewhere.

The parotid region is much swollen, wider than the skull, and about equal

the distance from snout to gular fold. The width of the jaws is contained about $4\frac{1}{2}$ times in the distance to the groin, a little more than five to the end of the anus. The gular fold is very distinct and even overlapping. Over behind the jaws and from the eye, obliquely along the side of the head and neck, are also very strongly marked.

The eyes are moderate, not prominent; the pupil similar. They are distant from the nostrils one orbit length; separated anteriorly $2\frac{1}{2}$ orbits. The nostrils are separated one orbit. There is a decided constriction at the neck.

The body is swollen and large; a little depressed at its circumference, at the widest is nine-tenths the distance from snout to groin. There are twelve well marked costal furrows, from fore to hind leg; five pelvic; the 4th and 5th uniting just behind the anus.

The tail is about equal to the distance from snout to groin; it is subquadrate at base; $1\frac{1}{2}$ as high as wide, but becomes immediately oval in section, larger below, and more and more compressed to the tip. The edges are, however, rounded to the terminal third, where they gradually become sharp.

The legs are stout, thickened and rather short in proportion. The digits are much depressed; short, triangular in shape, tapering from the broad base to the tip, which are hardened and somewhat horny in appearance. The free portion of the longest is about one-third the total length of the limb from elbow to knee; sometimes even less. In the individuals which live on land, the digits appear longer and more cylindrical. The expanse of the outstretched toes is about four-fifths the distance from snout to groin.

The tongue is fleshy, broad, about half the width of the head, and with the outline of the papillose portion slightly emarginate behind.

The palatine teeth of this species extend across the palate very nearly from one side of the upper jaw bone to the other. The series is only interrupted along the median line; sometimes scarcely so. The line is obtusely angularly rounded anteriorly, the concavity behind reaching forward to about opposite the middle of the internal nares. The slightly convex anterior branches diverge backwards regularly nearly to the line of the inner nares, where the angle of divergence becomes still greater, and the line becomes nearly straight, or even concave, anteriorly.

There are considerable variations in the outline of the curve of palatine teeth, as will be given below.

In alcohol this species is of a dark livid blackish brown, paler beneath. On the upper surface, generally on the side of the tail and limbs, are nearly circular yellow spots, about the size of the eye, and generally sharply defined. These are much like those of *A. punctatum*, though not quite so distinct, and although a faint indication of arrangement in ten dorsal rows may be traced, yet these are less symmetrically disposed, and single ones are scattered between the others along the back. Similar scattered spots are seen along the belly, which again is bordered, as on the lower part of the sides, with larger, more quadrate spots, which are more or less confluent, giving rise to elongated blotches, overpowering the ground color. This is also sometimes the case on the belly, and almost always on the chin, or beneath the head and neck.

The rounded spots above sometimes vary considerably in size, and occasionally are almost wanting. Sometimes they are more or less confluent, in which case there is usually a predominance of yellow on the belly. In a large series of specimens, I have not observed any vertical yellow bands on the side of the tail.

In the young just perfected from the larva the upper parts are dark brown, the under parts uniform, of a brownish yellow apparently. The yellow spots next make their appearance, becoming more and more prominent to a certain age. In very old specimens the dorsal spots become indistinct, but may generally be discovered when held under water or alcohol.

[Dec.

Dimensions of 4691.

| | |
|--|------|
| From snout along axial line to end of mouth..... | 55 |
| " " " gular fold..... | 1-00 |
| " " " groin..... | 3-50 |
| " " " end of anus..... | 4-40 |
| " " " " tail..... | 8-00 |
| Width of head..... | 80 |
| Fore arm from elbow..... | 80 |
| Hind leg from knee..... | 1-10 |

The largest specimen before me measures ten inches (4003, Racine). In this the tail from behind anus is as long as the rest of the animal. DeKay describes one of eleven inches in length.

Measurement of a typical specimen of the var. *tigrinum*.

| | |
|---|------|
| 4692. (1.) Length from snout to end of mouth along median line..... | 45 |
| " " " gular fold..... | 90 |
| " " " groin..... | 3-10 |
| " " " behind anus..... | 3-75 |
| " " " tip of tail..... | 7-55 |
| " of tail..... | 3-80 |
| Width of head..... | 70 |
| Fore arm from elbow..... | 75 |
| Hind leg from knee..... | 95 |
| Greatest height of tail..... | 65 |
| Stretch of hind legs..... | 2-80 |

In this variety the most appreciable difference in color consists in the tendency to transverse or vertical bars of yellowish on the side of the tail more or less confluent.

I find no difference in form between the two series of the supposed *A. episcopus* now at hand, 3899 and 3887, and young specimens of *A. luridum*, as 3971, from Marietta, Ohio. The color above is light reddish brown, the sides a sharply defined dusky brown; the belly of a lighter shade of the color of the back. There are some very obsolete indications of whitish spots in the belly and sides. I am by no means convinced that these are not light colored varieties of *A. luridum*. I have, however, not been able to find the original specimens.

The following examination of the nature of the variation to which this species is subject, and their causes, may be added to the preceding diagnosis from Baird's MS.

The color varieties are as follows:

a. Uniform brown above, yellow below, sides darker brown; 3887, 3899, three specimens.

β. Blackish brown, with small scattered yellow spots above, and large ones on the sides; the majority of the individuals; Nos. 4003, 4097, 4691, 3974, 3895, 3966, 3983, 3970, 3950, 2971, 4692, 4706, and eight in Mus. Academy.

γ. Nearly equally and not coarsely marbled above with blotches of deep brown and bright yellow; 4059.

δ. Entirely yellow, with brown linear patches irregularly arranged; type of *A. ingens* from New Orleans; one specimen.

The above coloration varieties, it will be observed, coincide in part with those of *A. mavoritum*.

The conditions of preservation of immature stages in the dentition are as follows:

A. Palatine series nearly entirely transverse behind the internal nares; eight specimens, all from New Jersey, except two from Root River, Wisconsin, 4093, and one from Louisiana, 4706. All are fully developed, and many of the largest size; one of 4093 has the postnarial dental series separated on one

1867.]

side. Of these, the largest example of the species is from Root river; with the other mentioned, the width of the head enters the length of the groin 4.5 times; and the tail is longer than head and body; the same relations are seen in two New Jersey specimens. Two from the latter State have the long tail, but the width of the head is only one-fourth length to groin, while one of the same have the longer body (4.5 times) but the tail shorter than head and body; two specimens have both the short body and tail. The elongation of the tail and body scarcely occurs in connection with any other type of dentition, and it is mentioned here to show the greater general completeness of development in these Eastern individuals.

B. Series slightly arched, not passing between nares. Two specimens large. In No. 3993 both outer segments are well separated from the median; the tail is longer than head and body, and width of jaws 4.33 to line of groin; this individual is aberrant.

C. Series angulated, not extending anterior to anterior margin inner nares; Nos. 3956, 2971, 3983, 3895, 3899a, embracing five specimens. Three large sp. in Academy Mus. and type of *A. ingens* Green in same.

This last specimen is peculiar in some respects, as already noted in coloration. The head is relatively a little wider than in other specimens of the same large size, the width entering the length to the groin four times, as in individuals of the smaller average size of the species. The length of the eye fissure enters 2.5 times the interorbital width, instead of twice, though in one of equal size from Root River it enters 2.2 times. The nares are not more than usually separated, hence the muzzle is more contracted than usual; it is also depressed in profile, but not more than in some other specimens. I believe it not to be a distinct species, but a form dependent on causes similar to those producing others here enumerated, and not more permanent than these so long as those causes are not universal. In other words, it is a large specimen with teeth, head and tail of adult character, but body and muzzle more larval. The fold on the hind leg and outer toe, mentioned by Green, is not marked, or different from that seen in the species generally.

No. 4097, sixteen specimens from W. Illinois, two have the series divided into four; 4093, two sp.; No. 4691, Cook Co., Ill., thirty-four specimens, one has the three interruptions, and five, with one of 4093, a median, making two series of teeth.

Of series C, the tongue is of normal size and the branchiæ absorbed, except in twelve specimens, No. 4691, of which five present stumps of the branchiæ; and two, 4097, where both the tongue is very small and the gill stumps remain. The width of the head is .25 to groin, and the tail never longer than head and body.

D. Median series arched, extending anterior to anterior margin of inner nares. One specimen, 3966, is fully developed in all other points.

E. Palatine series angulated, extending anterior to inner nares' anterior border. Nos. 4057, 3974, 3070, two of 4093, 3887, 3897b, four of 4097, nine of 4691. All of these have the short head and tail given in the preliminary diagnosis. The small or larval tongue occurs in one of 4093, 3070, 3974, nine of 4691, two of 4097; branchial rudiments remain in two of 4097, and nine of 4691. No. 4057 is remarkable in having a very small tongue and short deep tail, no stumps of branchiæ, and brilliant coloration, with large size and general adult appearance. It compares with certain specimens (4693, 3984), of *A. mavorium* in this strong retention of some larval characters, and like them is from northern Minnesota, a region noted for its cold and late seasons.

Measurements of No. 4057.

| | |
|--|------|
| Length of snout to end of gape of mouth..... | 55 |
| “ “ gular fold..... | 1.00 |
| “ “ groin..... | 3.50 |
| “ “ behind anus..... | 4.30 |

[Dec.

| | |
|---|------|
| Length of snout to end of tail (about)..... | 8.55 |
| " of tail about..... | 4.25 |
| Depth of tail (at end vent)..... | 1.95 |
| Width of head..... | 1.00 |
| Fore arm from elbow..... | .90 |
| Hind leg from knee..... | 1.10 |
| Stretch of hind leg..... | 3.40 |

A specimen entirely similar except in size and coloration, was found by Dr. Horn, near Beesley's Pt., New Jersey, a well known locality for the species. The tail is remarkably thick and deep at the base, and only equal from its basis to the canthus of mouth. A groove in the dorsal line behind, tail not grooved. The color is a dark leaden brown, sprinkled everywhere with small yellow spots; spots large, on tail; belly yellowish. Total length 6 in. 5 l.

From the preceding investigation we gather that larval characters in this species are in part only cotemporaneous; that the branchiæ are lost first, the tongue develops next and the teeth last. That the development extends in older age to the lengthening of the body and tail. That the progress may be arrested at a time when different degrees of combination of these and other features exist. That reproduction may take place at any of such different stages, is evident from the condition of development of the ova of many of the various specimens; and it is known to take place in other species at earlier stages than any recorded here as adult.

It is also to be noted that specimens from New Jersey are almost always more fully developed than those from the western regions; the former is a warmer district than the latter. Of two specimens from New Orleans, however, one only exhibits the dentitional characters of the New Jersey individuals. The characters common to the western individuals have occasioned the opinion that it was another species, which was called *A. luridum*.

Axolotls, or reproducing *Amblystoma* larvæ from Mexico, have recently reproduced in the Garden of Plants, as before stated, and the offspring have lost most of their larval features remarkably early. Prof. Duméril finds the teeth of these specimens to resemble those of the supposed *A. luridum*, and adds that they may belong to that species. This is not probable from the habitat. The *A. mavortium* extends into Northern Mexico, as far as the limits of the Fauna Nearctica, and it is more likely to prove to be this species.

It must be observed that this large species, whose description follows, differs absolutely only in the broader muzzle, and wider separation of the outer nares. The *A. tigrinum* retains in this case a feature characteristic of the larva of *A. mavortium* and of all other *Siredon* species. The range of color variation is only partly different in the two, but the majority of specimens of each belong to different color types. Each occupy a different geographical area, both of which are well marked in the distribution of many other reptiles. Nevertheless, ultimately I think it quite possible that they will have to be viewed as developmental forms like so many other supposed species, which are not sufficiently isolated from one another at the present time to warrant them distinct places and names in the system.

The *Siredon* of the Table Land of Mexico is different from those of the species described in this essay, as already pointed out.* As the metamorphosed stage, if existing, has not yet been obtained, I introduce it into this synopsis by name only.

| Cat. No. | No. of Spec. | Locality. | From whom received. |
|----------|--------------|---------------------|--|
| 3979 | | Detroit. | Dr. A. Sager (type of <i>A. luridum</i>). |
| 4691 | 40 (ad.) | W. Northfield, Ill. | R. Kennicott. |
| 4097 | 30 | N. Illinois. | |
| 4003 | 6 | Racine, Wis. | Dr. Hoy. |
| 3983 | 1 | Rock Island, Ill. | J. D. Sergeant. |

*Proc. A. N. Sci., Phil., 1866, 300.

| | | | |
|-----------|---|--------------------------|----------------------|
| 3992 | 2 | S. Illinois. | R. Kennicott. |
| 3974 | 4 | Columbus, O. | L. Lesquereaux. |
| 3971 | 1 | Marietta, O. | Prof. Andrews. |
| 4706 | 2 | Grand Coteau, La. | St. Charles College. |
| 3966 | 2 | Mississippi. | Dr. Shumard. |
| 3956 (30) | 1 | New York. | J. C. Brevoort. |
| 3895 | 1 | St. Louis. | Dr. Engelman. |
| 3993 | 1 | Russellville, Ky. (1852) | Dr. Geo. R. Bibb. |
| 4040 | 2 | Lake Encenito, Ill. | J. Potts. |
| 3899 | 2 | Detroit, Mich. | Dr. A. Sager. |
| 3887 | 1 | Ann Arbor, Mich. | S. F. Baird. |
| 4707 | 1 | Racine, | S. F. Baird. |
| 4059 | 1 | Fort Ripley, Minn. | Dr. J. F. Head. |
| 4692 | 3 | Beesley's Pt., N. J. | S. F. Baird. |

AMBLYSTOMA MEXICANUM Cope.

Gyrinus m. (1800?) Shaw and Nodder, Nat. Misc., pl. 342, 343. *Siren pisciformis* (1802?) Shaw, Gen. Zool. Amph., p. 612. *Siredon axolotl* (1833) Wagler, Jones' Amph., pl. 20; Axolotl (1811) Cuv., Rept. dout. in Humb., Obs. Zool. 104, pl. 14. *Hypoethon pisciformis* (1829) Gravenhorst, Del. Mus. Vratislav., p. 89. *Acholotes guttatus*, (July, 1844,) R. Owen. Ann. and Mag. Nat. Hist. xiv., p. 23.
 ? Lakes, City of Mexico. Dr. C. Sartorius.
 4. Table Land, Mexico.

AMBLYSTOMA MAVORTIUM Baird.

Journ. Ac. Nat. Sci. Phila. 1847, 292. Hallowell, l. c. iii. *A. proserpine* Baird. Hallowell, l. c. 354. *A. maculatum* Hallowell, l. c. 355, Proceed. 1857, 215. *Camarataxis maculata* Cope, Pr. Ac. Nat. Sci. Phila. 1859, 122. *A. nebulosum* Hallowell, Sitgreave's Rep. Zuni and Colorado, J. A. N. Sci. iii. 352. *A. californiense* Gray, Proc. Zool. Soc. London, 1853, 11, Tab. *Desmlostoma maculatum* Sager, Peninsular Journ. Medicine, 1858, 428.

Palatine teeth in a transverse series, more or less angular anteriorly; reaching to the posterior border of the inner nares, or one diameter beyond. The angle sometimes flattened or rounded. The series scarcely or not at all interrupted on the median line; never (?) on the limbs, which are generally a little undulatory.

Inner nostrils separated by the same space as the outer.

Tongue broader than long; more than half the width of the head; thick and fleshy.

Body very heavy, with 12 costal furrows. Head very broad, contained about $3\frac{1}{2}$ times in distance from snout to groin. Tail about equal to the same distance, much compressed from the base. Males in breeding season with a distinct fin from near the base of the tail above, and from beyond the middle below; tail more oval at other seasons. Cloacal region of male much swollen, emarginate—angular behind.

Legs moderate; digits much depressed, very broad at base; triangular, and adapted for swimming. Free portion of digits about one-third the distance from their tips to elbow or knee.

General color dark brown or blackish; in alcohol varied with blotches of yellow. These are disposed along the median line of the back and tail (extending down on the sides) as transverse ellipsoid bands of large size, perhaps equal to the space between the costal grooves. The blotches of opposite sides sometimes alternate, sometimes are opposite, and are frequently confluent here and there, which is generally the case on the tail, where they form yellow, encircling rings interrupted below. Along the sides of belly and lower part of the sides is a similar series of yellow ellipses, but usually larger; those of the same side usually somewhat confluent, sometimes entirely so, leaving a dusky central line of the belly. The limbs are blotched black or yellow.

[Dec.

The yellow sometimes predominates so as to almost form the ground color, encroaching largely, too, on the yellow of the belly. In general, however, there is little or no tendency to anastomosis or reticulation of the dark interspaces as in an allied species. Smaller rounded irregularly scattered spots of yellow are seldom if ever seen as in *A. var. luridum*.

The ground color is sometimes uniformly dusky above, although the lighter transverse ellipsis can usually be made out; perhaps they are always appreciable in life.

In the preceding general description I have endeavored to represent the distinguishing features of what I believe to be a single species, varying very much in shape of palatine teeth, proportions, color, etc. From the synonymy it will be seen that I combine under the oldest name of *mavortium*, *proserpine*, and *nebulosum*. Although the type specimens of these supposed species differ sufficiently among each other, yet there are sufficient connecting links in the large series before me, and it would be no difficult task to pick out a dozen more specimens each as distinct from each other and the above as the latter are among themselves.

One great source of the diversity of character in different specimens of this protean species is to be found in the very different size of specimens in the same stage of growth, while in some the full metamorphosis will have been accomplished with a length of three or four inches; in others the branchiæ are still visible at a much greater size. In one female specimen of 8 inches in length (4978) the branchiæ are still appreciable, the fissures in the neck not being closed up, although the ovaries and oviduct would indicate that it was captured when in full breeding condition. This embryonic tendency is almost always indicated further by shorter gape of the mouth; the tongue smaller, flatter, more adherent, not at all or very little free at the edges, and little or not at all papillose, but exhibiting a cartilaginous surface. The palatine teeth in the embryonic state are alone usually more arched anteriorly; more or less parallel with the maxillary series; less prominent above the soft palate, and extending to a less distance laterally. The digits are more depressed, their outlines more oval than triangular, the 3d and 4th toes and 2d and 3d fingers more nearly equal.

The development of the different embryonic conditions may be carried on very unequally in different specimens, so that it is very unsafe to base specific characters upon small individuals, or even upon large ones in which there is the slightest indication of the branchial slits or their tufts.

The same adult individual differs, too, in different seasons. While some species appear to reside almost entirely in water, others do so only partially. Even the same specimen may pass a more aquatic life in one year than in another. A more persistent residence in water is shown by the broader and more depressed digits, higher and more compressed tail, and more or less decided ridge (sometimes even membranous). I have no doubt that an animal, while possessing these features in marked degree when in the water, would lose them to a measurable extent after a lengthened residence on land. This aquatic habit is generally greatest during the breeding season.

The preceding diagnosis and remarks are taken entire from Prof. Baird's manuscript. I will further extend and illustrate the same, and add that the names *A. californiense* and *A. maculatum* have been applied by Gray and Hallowell, and *Desmistioma maculatum*, by Sager, to forms of this species.

Various changes of form during the late metamorphosis of this animal have been already enumerated in the prefatory remarks on the genus. A feature of difference mentioned above, the varying length of the fourth digit, appears to be quite independent of other developmental conditions. In a specimen in the Mus Academy, from Kansas, this digit has but three phalanges on both feet; in another from the same locality 3 on one, 4 on the other foot, and the same occurs in No. 3994 Mus Smithsonian. In all the other specimens at my disposal they are, as in this section of the genus, 4—4.

1867.]

The varieties of this species, which may be distinguished by their coloration are as follows:

a. (*californiense*.) Blackish, with slightly paler belly; a series of large oval yellow spots on lower part of side and tail (in one specimen a few on each side of dorsal line). System of mucous pores well developed, especially below ramus of the jaw on each side. From California only; eight specimens; No. 4081.

β. Brown, yellowish below; larger lateral and smaller dorsal yellow spots, irregularly arranged. Fewer mucous pores on each side the gular region. Fourteen specimens; mostly from Kansas and Nebraska, one from Missouri, one from lat. 38°, two from New Mexico, and two from Chihuahua. Nos. 4065, 4040, 3955a, 4062, 4084, 4908, 3984a. The type of *A. nebulosum* belongs here. There is no material difference between this and the coloration of *A. tigrinum*.

γ. Ground brown, crossed by transverse yellow bands, which inosculate more or less on the dorsal region, so as to obscure, sometimes almost entirely, the ground; mucous pores as in the last; belly with a median dark or black band. Sometimes the yellow is shaded with olive. Nos. 4613, 4705, 3990, 4703, 4694 to '99, 3955, 4078, 4079, 4066, 3982, 5359, 4082, 3994. No. 4020 might be assigned to either *β* or *γ*.

δ. Ground olive, with numerous small brown spots; otherwise as above. No. 4693 and the type of *A. maculatum* in Mus. Academy.

ε. Brown above, yellowish below; otherwise as above; 3984b, 4702, 3992, 3955b; from most diverse localities.

ξ. Color as in *γ*, the yellow leaving only inosculating lines of brown; no frontal, nasal or mandibular series of mucous pores; 4698 one specimen

So much to the principal of ornamental variation; the following are the forms resulting from unequal development of parts; the reader will observe by the numbers how partially they coincide with each other and with the preceding.

Type A. Palatine teeth in a gentle arch convex forwards, not extending between nares; the teeth (but not the ridge) interrupted inside the series behind the nares. Nos. 4908 and 5359 (2 sp.); in all respects fully grown, the former not more than half the size of the usual type. Approach distantly *A. trisruptum* Cope.

Type B. Palatine teeth forming a straight series on each side, meeting at a more or less open angle between the nares. Most of the specimens: Nos. 4702, 3992, 4705, 4613, 4065, 4040, 4698, 3990, 4703, 4694 to '99, 4081, 3955, 4079. Of these the angle of the tooth series does not extend beyond the anterior margin of the nares in twenty-six specimens, of which one exhibits a small, undeveloped tongue, and none have the stumps of the branchiæ remaining. In eleven specimens the angle extends beyond this point (in 3990 and another approaching an arch in form); and of these the tongue is small and larval in six, and in one of these stumps of the branchiæ remain; this last is of medium size only, but Nos. 4693 and 3694 are large, the first very large; they add the larval character of a short, deep tail. It is to be noted that these specimens are from Minnesota and the borders of British America, regions subject to great cold, to which cause we may, with much probability, assign their characters. Two individuals presenting the same peculiarities are described under the head of *A. tigrinum*. Of two specimens from Chihuahua, fully developed, the teeth are of the two types: of eight from California one presents the second type only; it is otherwise fully developed.

Type C. The postnarial portion of the palatine series has nearly or quite assumed its transverse position, while the median series remains in its larval arch, extending more or less in advance of the nares. Eight specimens, four of the largest size: 3955a, 4078, 4062, 4084; two Mus. Academy. one type of *A. maculatum* Hall. Of these two have the small tongue and traces of branchiæ, while four are fully developed in these respects.

Type D. Palatine series forming a parabolic arch from one extremity to the
[Dec.

other, extending in advance of the nares. Three specimens, two of them of full but not large size; one of the former full double the size of others from the same locality (the Platte Valley), which are referred to Types C and B, has larval tongue and branchial stumps. The others, 4066, with larval tongue, but the branchiæ absorbed.

Here may be mentioned a remarkable specimen, 3982, which is in all other respects fully developed, where the larval arch of teeth remains, but has become open and slightly transverse, extending but little beyond the anterior margin of the nares. It is intermediate between Types D and A, and is the result of a retardation in development of the larval arch, while Type B is produced by a retardation or preservation of the oblique lateral series of the larva, at the expense of the arch.

I add here a description of the var. *californiense*, for the sake of determination of varieties and species that may be found hereafter.

The proportions of this variety and general character of the glands, pits, etc., appear much like those of *A. var. luridum*, in some respects of *A. punctatum*. I do not detect any patches of large pores on the top of the head and neck in one specimen, but in another a series of large whitish dots beneath the epidermis seems to indicate their presence. Of these one patch is placed on top of head within the orbit; another on the parotid region. Some pores, however, are distinctly visible behind the angle of the mouth, sending forward a series along the margin of the lower jaw, under the chin.

The head is broad but also long, the width being decidedly less than the distance from snout to gular fold. The gape is very large, the length nearly two-thirds the width. The width in seven specimens is contained $4\frac{1}{2}$ times in the distance from snout to groin; in one specimen four times only. The eyes are separated only by $2\frac{1}{2}$ lengths of the orbit.

The tongue is very large, nearly filling the whole lower jaw. It is three-fourths the width of the head.

There is quite a difference in the character of the palatine teeth of the ten specimens before me. In both the central part of the series forms a decided V; the angle sharp, and reaching to the line of the anterior margin of the inner nostrils. The limbs extend backwards slightly in an S shape to a short distance behind the inner nostrils and in line with their inner border, and then connect with the external segment of the palatine series, which extend (nearly transversely but a little oblique backwards) to a line with the outer margin of the inner nostrils. In both specimens the two sides of the palatine series are not symmetrical and of unequal length, one specimen showing a distinct interval between the central V and the lateral segment, as well as at the angle of the V; in the other these four elements are continuous.

There appear to be 12 costal furrows. The tail is compressed but not high; in one specimen it is as long as head and body; in another shorter; shows a sharp ridge above from near the base and from the terminal half below in one specimen; not so much in another. The limbs are well developed; the digits depressed and triangular, but less so than in many aquatic *Amblystomata*, as *A. luridum*.

The color of the species is blackish in alcohol, rather paler below. On each side of the belly or lower part of the sides of body and tail is a series of bright sulphur yellow spots, mostly nearly circular, sometimes oblong, and varying in size, though generally larger than the orbit. The spots are few in number—five or six from head to tail, and four or five on the side of tail.

In one of the specimens are some smaller rounded spots on each side of the dorsal line; three or four in each series; these are not symmetrically disposed, as in *A. punctatum*.

As Dr. Gray remarks, this species has a certain resemblance externally to *A. punctatum*, which, however, never exhibits the series of spots on the side 1867.]

Free portion of longest finger contained in distance from elbow to tip, not quite 3
 " " toe " " knee to tip..... 3
 Length tail from behind anus, to rest of animal..... less.

Measurements.

| | |
|--|------|
| Length (measured along axis of body) from snout to gape..... | 40 |
| " " " " gular fold..... | 85 |
| " " " " armpit..... | 1.25 |
| " " " " groin..... | 3.00 |
| " " " " behind anus..... | 3.75 |
| " " " " end of tail..... | 6.20 |
| Width of head..... | .70 |
| " tongue..... | .45 |
| Length of orbit..... | .18 |
| Distance between eyes anteriorly..... | .40 |
| " " outer nostrils..... | .30 |
| " " inner nostrils..... | .30 |
| " " armpit and groin..... | 1.75 |
| Height of tail where highest..... | .30 |
| Breadth " "..... | .18 |
| Free portion of longest finger..... | .28 |
| From elbow to tip of longest finger..... | .80 |
| Free portion of longest toe..... | .30 |
| From knee to tip of longest toe..... | .90 |
| Distance between outstretched toes..... | 2.85 |

Proportional dimensions.

Specimen 3955 (1). Var. *navortium*. Fort Bliss.

| | |
|--|--------------------------------|
| Length of gape of mouth, to its width..... | $\frac{1}{2}$ |
| Width, to distance from snout to gular fold..... | equal. |
| " " " " groin..... | cont. $3\frac{1}{2}$ times. |
| " " " " behind anus..... | $4\frac{1}{2}$ " |
| From snout to gular fold, contained in distance from snout to groin..... | $3\frac{1}{2}$ |
| From snout to gular fold, contained in distance from snout to behind anus..... | $4\frac{1}{2}$ |
| Distance anteriorly between eyes, in length of orbit..... | 3 |
| " from eyes to nostrils " "..... | 1+ |
| " between external nostrils " "..... | nearly 2 |
| " " internal " "..... | $2\frac{1}{2}$ |
| Width of tongue, to width of head..... | rather more than $\frac{1}{2}$ |
| Free portion of longest finger contained in distance from elbow to tip..... | 3 |
| Free portion of longest toe contained in distance from knee to tip..... | nearly 4 |
| Distance between outstretched toes in length from snout to groin..... | once. |
| Length tail from behind anus, to rest of animal..... | nearly equal. |

Measurements.

| | |
|--|------|
| Length (measured along axis of body) from snout to gape..... | .60 |
| " " " " gular fold..... | 1.00 |
| " " " " groin..... | 3.50 |
| " " " " behind anus..... | 4.50 |
| " " " " end of tail..... | 4.90 |
| Width of head..... | 1.05 |
| " tongue..... | .55 |
| Length of tongue..... | .45 |
| " orbit..... | .22 |

1867.]

| | |
|--|------|
| Distance between eyes anteriorly..... | 65 |
| " " outer nostrils..... | 40 |
| " " inner " | 45 |
| Height of tail where highest..... | 75 |
| Breadth " | 45 |
| Free portion of longest finger..... | 30 |
| From elbow to tip of longest finger..... | 95 |
| Free portion of longest toe | 32 |
| From knee to tip of longest toe | 1-15 |
| Distance between outstretched toes..... | 3-50 |

Proportional dimensions of

| | |
|--|-----------------|
| Spec. 4082, type of var <i>proserpine</i> . Tamaulipas. | |
| Length of gape of mouth, to its width..... | more than half |
| Width, to distance from snout to gular fold..... | not quite equal |
| " " " groin..... | nearly 4. |
| " " " behind anus | 4½ |
| From snout to gular fold, contained in distance from snout to groin | 3½ |
| From snout to gular fold, contained in distance from snout to behind anus..... | 4 |
| Distance anteriorly between eyes, in length of orbit..... | 3 |
| " from eyes to nostrils " " | 1 |
| " between external nostrils, " " | 2 nearly. |
| " " internal " " | 2 " |
| Width of tongue, to width of head..... | more than half. |
| Free portion of longest finger contained in distance from elbow to tip..... | 3 times. |
| Free portion of longest toe contained in distance from knee to tip..... | 3 times. |
| Length tail from behind anus, to rest of animal..... | less. |

Measurements.

| | |
|--|------|
| Length (measured along axis of body) from snout to gape..... | 34 |
| " " " gular fold..... | 60 |
| " " " armpit..... | 90 |
| " " " groin | 2-00 |
| " " " behind anus..... | 2-40 |
| " " " end of tail..... | 4-10 |
| Width of head..... | 52 |
| Distance between eyes anteriorly..... | 32 |
| " " outer nostrils..... | 23 |
| " " inner nostrils..... | 24 |
| Height of tail where highest..... | 25 |
| Breadth " | 12 |
| Free portion of longest finger..... | 20 |
| From elbow to tip of longest finger..... | 60 |
| Free portion of longest toe..... | 19 |
| From knee to tip of longest toe..... | 61 |
| Distance between outstretched toes..... | 1-75 |

Proportional dimensions of

| | |
|--|-----------------|
| Spec. 4696. Cimarron R. | |
| Length of gape of mouth, to its width..... | about one-half. |
| Width, to distance from snout to gular fold..... | equal. |
| " " " groin..... | 4 |
| From snout to gular fold, contained in distance from snout to groin..... | 4 |

[Dec.

| | |
|--|----------------|
| From snout to gular fold, contained in distance from snout to behind anus..... | nearly 5. |
| Distance anteriorly between eyes, in length of orbit..... | 3 |
| " from eyes to nostrils " " | 1½ |
| " between external nostrils, " " | nearly 2. |
| " " internal " " " | 2 |
| Width of tongue, to width of head..... | little over ½. |
| Free portion of longest finger contained in distance from elbow to tip..... | 3½ |
| Free portion of longest toe contained in distance from knee to tip | 3½ |
| Distance between outstretched toes in length from snout to groin | about equal. |
| Width of body compared with that of head..... | equal. |

Measurements.

| | |
|--|------|
| Length (measured along axis of body) from snout to gape..... | -55 |
| " " " " gular fold..... | 1-00 |
| " " " " armpit..... | 1-55 |
| " " " " groin..... | 3-90 |
| " " " " behind anus | 4-75 |
| " " " " end of tail..... | 8 75 |
| Width of head..... | 1-00 |
| Length of orbit | -20 |
| Distance between eyes anteriorly..... | -56 |
| " " outer nostrils..... | -35 |
| " " inner " | -36 |
| Circumference of belly. | 3-75 |
| Distance between armpit and groin..... | 2-25 |
| Height of tail where highest..... | -70 |
| Breadth " " | -40 |
| Free portion of longest finger..... | -27 |
| From elbow to tip of longest finger..... | -95 |
| Free portion of longest toe..... | -32 |
| From knee to tip of longest toe. | 1-25 |
| Distance between outstretched toes..... | 3-55 |

| Cat. No. | No. of spec. | Locality. | From whom received. |
|------------|--------------|--------------------------------|---|
| 3990 | 1 | New Mexico. | Dr. J. Le Conte, type of spec. |
| 4084 | 1 | " " | " " |
| 4702 | 1 | San Francisco Mts., Nev. | { Capt. Sitgreaves, type of <i>A. nebulosum</i> . |
| 3955 | 5 | Fort Bliss, N. M. | |
| 4085 | 1 | Mimbres R. | Dr. S. W. Crawford. |
| 4078 (35) | 1 | Fort Thorn. | Dr. Webb. |
| 4705 | 1♂ | Fort Union, Neb. | Dr. Henry. |
| 4066 | 1 | Rock Creek, K. T. | Dr. Hayden. |
| 4079 | 1 | Fort Benton. | Lt. Bryan, W. S. Wood. |
| 4062 | 1 | Rocky Mts. | Dr. Hayden. |
| 4698 | 1 | Bridgers Pass. | Capt. Beckwith. |
| 4011 | 1 | Sand Hills of Platte. | Lt. Bryan, W. S. Wood. |
| 3982 | 1 | Ft. Pierre. | Dr. Hayden. |
| 4020 (84) | 2 | Fort Laramie. | Th. A. Culbertson. |
| 4695 | | Fort Riley. | Dr. Hayden (<i>proserpine</i> ?). |
| 4694 (2) | ♀ | Mo. of Cimarron. | Dr. W. A. Hammond. |
| 4697 (365) | ♂ | Lower Platte. | J. H. Clark. |
| 4696 | ♂ | N. Fork of Canadian. | Dr. J. H. Cooper. |
| 4699 | | Cimarron R., near Salt Plains. | J. H. Clark. |
| 4082 (91) | 3 | Tamapulipas. | " |

1867.]

| | | | |
|------|---|------------------------|------------------------------|
| 4057 | 1 | New Mexico. | Ed. Kern. |
| 3984 | | Lac qui Parle, Minn. | S. R. Riggs. |
| 4693 | | N. Red River, H. B. T. | C. Cavileer. |
| 4081 | 2 | Petaluma, Cal. | E. Samuels, soft spec. desc. |

Numerous specimens from near San Francisco in Mus. Compar. Zoology.

AMBLYSTOMA OBSCURUM Baird.

M. S. Species nova.

In the greatly corrugated condition of the present specimen, it is impossible to make out any satisfactory description of the integuments. They, however, appear much as in the other stout aquatic species. The head is very broad, and the gape unusually large. The internal nostrils are very large; their width half the diameter of the eye; the distance between their inner borders is the same as that between the outer. The tongue is large, broader than long; its width about two-thirds that of the upper jaw.

The palatine teeth are in four series collectively, forming a broad inverted V; the angle is anterior, and would be quite sharp but that there is an interruption along the median line. The branches reach as far forward as the anterior border of the inner nostrils. They are decidedly concave antero-externally. The two inner anterior sections of the palatine series are each about twice the length of the external ones; they fall short of the inner border of the inner nares by nearly a diameter of the latter, which space separates them from the outer section, which, immediately behind the inner nares, are about as long as the latter are wide, and do not pass exterior to their outer border.

As nearly as can be ascertained, there are twelve costal furrows. The tail is compressed, but not high.

The color appears to have been of a uniform brown above and on the sides; brownish-yellow beneath; on the sides, darker vertical blotches can be detected in the single specimen before me; similarly indistinct markings are visible on the tail.

The very convex frontal region, and the concave interrupted series of teeth alone distinguish this species from the *A. mavortium* of the brown variety. It differs from *A. tigrinum* in much larger inner nares, and more widely separated nostrils; the inner borders of the two being at about the same distance, instead of having the latter more approximated. The tongue is wider, as well as the head. The teeth are more V-shaped, reach farther forward; the outline of the limbs of the V is concave antero-externally, and interrupted by spaces equal to the wide nostrils; the outer sections not extending beyond the nostrils.

Measurements.

| | In. | Lin. |
|---|-----|-------|
| Length (along axis) from snout to gape..... | | 7.8 |
| " " " gular fold..... | | 12.75 |
| " " " axilla..... | 1 | 8.75 |
| " " " groin..... | 4 | 1.15 |
| " " " behind vent..... | 5 | 0.15 |
| " " of tail..... | 3 | 2. |
| " from elbow to tip of longest finger..... | | 12.75 |
| " " knee " " toe..... | 1 | 4.5 |
| Width of head at angle jaw..... | | 10.9 |
| " between eyes anteriorly..... | | 6.1 |
| " " external nares..... | | 4.5 |

| No. | No. of spec. | Locality. | From Whom. |
|------|--------------|------------------------|--------------|
| 3994 | 1 | Fort Des Moines, Iowa. | W. E. Moore. |

AMBLYSTOMA XIPHIAS Cope.

Spec. nov.

The specimen selected as the type of the description has the skin somewhat

[Dec.

altered by alcohol, so that an exact description cannot be made of the glands, pits and pores. There does not, however, appear to be any material difference from *A. tigrinum* in these respects.

The head appears small in proportion to the size of the animal, and the cheeks unusually swollen; the width of the head is contained five times in the distance to groin. The mandible projects beyond the end of the muzzle. The eyes are rather small, distant three lengths of the orbit. The inner nostrils are considerably more distant than the outer. The tongue is large and fleshy, filling the rami anteriorly, and more than half the width of the head. The inner nostrils are quite lateral.

The palatine teeth form a very obtuse angle anteriorly, reaching to about opposite the middle of the inner nares, and extending laterally beyond them by about one diameter. There is a slight interruption along the median line, but no appreciable one elsewhere. The limbs of the V are not straight, but form a double curve (scarcely appreciable) on each side.

There are twelve costal grooves; others are not appreciable, except those at the base of the tail.

The tail is very long, considerably exceeding the rest of the animal; much compressed from the base, though not elevated. Oval in cross section, and only becoming sharp near the tip, without any crest. No grooves are visible along dorsal or ventral outline.

There do not appear to be any peculiarities in the feet distinguishing it from other aquatic *Amblystomas*.

The color of this species is a yellowish-olive; brighter yellow beneath, with more or less anastomosing or reticulating bands of well-defined brown on the back and sides, and a few rounded spots of the same on the belly. These bands in width average perhaps the diameter of the eye, though variable in this respect.

Compared with *A. tigrinum* this species has a proportionally smaller head, much longer tail, and different color; yellow predominating in the one, and brown in the other. The relationship, however, appears to be very close. The digits perhaps are narrower, though also triangular and depressed.

A large *Amblystoma mavortium*, No. 4705, from Fort Union, at the mouth of the Yellowstone, with the same coloration as the preceding, differs in rather shorter tail, the ridge of which is more acute; broader toes; and a considerably broader and otherwise different head, the width of which is contained about four times in distance from snout to groin, not five times. The palatine teeth do not extend laterally beyond the centres of the inner nostrils, which are separated more widely than are the outer. The tongue is larger and more fleshy. The dusky marks on the tail are not reticulated, but transverse, and the under side is dusky, not yellow. This very great and marked difference in the form and size of the head of the two specimens, although that with the smaller head is considerably the larger of the two, indicates the distinctness of the species.

Measurements.

| | In. | Lin. |
|---|-----|-------|
| Length (along axis) from snout to gape..... | | 7.25 |
| " " " gular fold..... | 1 | 0. |
| " " " axilla..... | 1 | 11.25 |
| " " " groin..... | 4 | 2.5 |
| " " " behind vent..... | 5 | 3. |
| " of tail..... | | 6 |
| " from knee to tip of longest toe..... | 1 | 3.1 |
| Width of head at angle jaw..... | | 10.5 |
| " between eyes anteriorly..... | | 6.5 |
| " external nares..... | | 3.7 |

Measurements.

| | |
|---|------|
| Length (measured along axis of body) from snout to gape | 45 |
| “ “ “ “ gular fold | 90 |
| “ “ “ “ armpit..... | 1.45 |
| “ “ “ “ groin | 3.15 |
| “ “ “ “ behind anus..... | 3.80 |
| “ “ “ “ end of tail..... | 6.80 |
| Width of head..... | 80 |
| “ tongue..... | 45 |
| “ orbit | 18 |
| Distance between eyes anteriorly..... | 50 |
| “ “ outer nostrils..... | 22 |
| “ “ inner “ | 30 |
| “ “ armpit and groin..... | 1.80 |
| Height of tail where highest..... | 46 |
| Breadth “ “ | 24 |
| Free portion of longest finger..... | 26 |
| From elbow to tip of longest finger..... | 90 |
| Free portion of longest toe..... | 29 |
| From knee to tip of longest toe..... | 96 |
| Distance between outstretched toes..... | 3.00 |

One spec. 4068. ♀ Ocate River, N. M., from John Potts.

AMBLYSTOMA JEFFERSONIANUM Baird.

Jour. Acad. Nat. Sci. i. 283. *Salamandra* Green, Contr. MacIurean Lyceum i. p. 4, 1827; Holbr., N. Amer. Herp. v. 51, pl. 14. *Triton niger* Dekay, Geol. Surv. N. Y. Zool. iii. 85, pl. 15, f. 35. *Salamandra granulata* Dekay, l. c. 1842, 78, pl. 23, f. 66. *Xiphonura jeffersoniana* Tschudi, 1838, Class. Batr: Gray, Catal. Brit. Mus., 1850, 34. *Amblystoma fuscum* Hallow., Journ. A. N. Sci. iii. 355. *Amb. laterale* Hallow., l. c. 352.

Body decidedly more slender and elongate than in *A. punctatum*. Skin everywhere smooth, and showing through the transparent epidermis the ends of the glands, which thickly stud the entire surface. Under a lens are seen numerous small rounded, shallow pits between the glands, not on them. The contraction of the skin, in strong alcohol, between these glands, would readily impart a granulated appearance. The glandules are accumulated into a thin stratum above the parotid groove.

The head is elongated, with the muzzle obtuse or truncate, the greatest width contained one time in the distance to gular fold, and from four and a half to five times to the groin; the distance to the gular fold is contained three and two-thirds times in that to the groin. The eyes are rather large, and situated far behind. They are distant once the length of the orbit from the nostrils (which are separated by nearly twice this length). The anterior extremities of the orbit are distant more than twice this length.

The gular fold or furrow is distinct, not very prominent above; that behind the angle of the jaws is inconspicuous, as is the lateral parotid furrow.

There are twelve costal furrows, including the inguinal and axillary.

The tail is a little shorter than the body and head (measuring from posterior extremity of vent.) It is oval in cross section, largest below, though without any ridge or crest. It is little higher than broad at the anus, but becomes more and more compressed to the tip, the upper and under outlines remaining nearly parallel for a considerable distance. The anal slit is prolonged into a groove, which extends beneath the tail to its very tip.

The tail is curved strongly upwards in the alcoholic specimen, but this is due to the corrugation of the spirit.

The limbs are largely developed, and the toes very long. The digits cylindrical, depressed, without any lateral or basal web. The third finger is long-

est, then the second, fourth and first. It is one-third the length of arm from elbow. The fourth toe is longest, then the third (but little shorter), second, fifth and first; it is contained about two and a half or two times in the length of leg from knee. The expanse of the outstretched toes is very nearly equal to the distance from snout to the groin. The length of the limbs varies a little; when extended on the sides they may scarcely meet, or considerably overlap.

The tongue is thick and fleshy; much as in *A. punctatum*.

The teeth are in four patches; the two central in nearly a straight line, or forming in smaller individuals a very obtuse Δ , the angle anterior, but not passing the posterior border of the internal nares; the sides of the Δ are perhaps slightly concave anteriorly. This patch or line extends to the inner nares, and is there continuous with the lateral patches, which are short, nearly straight, about one-fourth the central patch, and form the posterior border of the inner nares. These are large, far back, and widely separated.

In alcohol, after long immersion the specimen is nearly uniform light liver-brown, paler beneath, without any spots.

| | |
|---|------|
| Length from snout to gular fold..... | 70 |
| " " groin | 2-55 |
| " " end of anus..... | 3-20 |
| " remnant of tail..... | 2-50 |
| Width of head..... | 50 |
| Length of mouth, along median line..... | 38 |
| " forearm from elbow..... | 62 |
| " leg from knee..... | 85 |

The specimen from which the preceding description has been taken, is, if not the original upon which Dr. Green's species was founded, at least one collected in the same locality and named by him, having formed part of his collection, and presented many years ago by its owner to the Smithsonian Institution. The "light blue spots" so conspicuous in fresh specimens have disappeared.

Dr. Holbrook, in describing this species has mixed with it the account of the tongue and teeth of *Plethodon glutinosus*, which it somewhat resembles, but which may be readily distinguished externally by the lighter silvery spots, and much shorter digits. This induced Dr. Hallowell erroneously to make the species a synonym of *P. glutinosus*. The error had its origin, no doubt, in the nearer resemblance of the var. *laterale* to the latter species.

A confusion of the specimen described with the type of DeKay's *Salamandra granulata*, exhibits no appreciable difference except in the darker color, rather more depressed toes, and perhaps more massive looking jaws of the latter, the muzzle a little more pointed; all uncertain characters in alcoholic specimens. The palatine teeth are in better preservation than in the specimen here described. The central patch is interrupted along the middle line and does not extend quite so far laterally. The legs and digits are much lengthened, the figure and description of Holbrook (see DeKay) conveying a very erroneous impression in this respect. The granulation referred to is in part the optical effect of the glands of the skin, showing through the transparent epidermis; partly the result of contraction of the skin by alcohol.

In the typespecimen there are no symmetrically arranged patches of pores on the head. Their absence may be owing to the long continued preservation of the specimens or to some accidental deficiency. In the type of *granulata* these are quite visible. They are very distinctly shown in No. 4688, where there is seen a straight series interior to the eye and nostril (not reaching to the latter), bending abruptly behind the eye and passing beneath it. On the parotid region above the lateral groove is a slightly curved line

[Dec.

of six or eight pores, and a shorter straight one above it. Below the groove is a crowded patch which is continued into a simple series along the inner edge of the lower jaw. One or two are seen at the side of the base of the lower jaw, and others along the sides of body.

It has been stated that in the type no indication of light spots was visible. In others, however, of more recent preservation, these are quite evident. In the smallest specimen of 3998 are visible numerous rounded irregularly disposed light spots on the lower part of the sides, with some scattered over on the belly averaging half the size of the eye, but with faintly defined margins. Some scattered ones are seen on the side of the tail; these may be plumbeous or bluish in life.

In the largest specimen of 3979, Ripley, Ohio, these bluish spots are quite evident on the side of body and tail.

Generally the ground color is, of the alcoholic specimen, olive brown, sometimes blackish, lighter beneath. The color of the living animal is similar to that above described from alcoholic specimens.

The youngest specimen examined is about two inches long and is not materially different from the adult, although the two inner palatine patches appear more arched.

There are two varieties of this species other than the typical, as follows:

Var. *fuscum* (*Amblystoma fuscum* Hallow.) is dark brown, with an especially dark shade or band along the sides. Type in Mus. Academy from near Hanover Co., W. Indiana. 3697 Mus. Smithsonian, Clarke Co., Va.

Measurements of 3697.

| | |
|--|------|
| Length from snout to end of mouth..... | 30 |
| “ “ gular fold..... | 55 |
| “ “ groin..... | 1.90 |
| “ “ end of anal slit..... | 2.25 |
| “ “ end of tail..... | 3.80 |
| Width of head..... | .40 |
| Fore arm from elbow..... | .50 |
| Leg from knee..... | .62 |
| Extent of hind leg..... | 1.60 |

Var. *laterale* (*Amblystoma laterale* Hallow). The length of the fissure of the eye enter the width between the anterior canthi of the same twice only. The color black with large white spots on the sides and tail, and smaller ones on the belly. Size about half the size of the adult of the typical variety, and the medium series of palatine teeth convex forward. The distribution of this form is northward. Specimens 7011 and 5941 from Milwaukee and high land between River St. Lawrence and Hudson's Bay. In Mus. Academy, from Michigan and from north side Lake Superior.

The dark color of the coagulated blood in the vena lateralis gives rise sometimes to the deceptive appearance of a color stripe.

| Cat. No. | No. of Spec. | Locality. | From whom received. |
|----------|------------------|----------------------|--|
| 3968 | 1 | Canonsburg, Pa. | Dr. F. Bahe. |
| 3979 | 4 | Ripley, Ohio. | Dr. Hoy. |
| 3998 | 1 is } 7145 } | 12 Cleveland, Ohio. | Dr. Kirtland. |
| 3989 | 2 | New York, | N. Y. State Cab. (type of <i>S. granulata</i> , DeKay. |
| 3997 | 1 | Racine, Wis. | Dr. Hoy. |
| 4689 | 1 | Lake Superior. | Dr. Hoy. |
| 4690 | 2 | St. Catharine, C. W. | D. W. Beadle. |
| 3888 | 2 (larva) | Burlington, Vt. | Z. Thompson. |

Also from Philadelphia.

1867.]

AMBLYSTOMA PLATINEUM, Cope sp. nov.

This is one of the more elongate species and in many respects allied to the *A. jeffersonianum*.

The head is oval and the muzzle rounded. The length of the fissure of the eye equals the distance of the nostril from the same, is but little less than the distance between the nares, and half or a little more of the distance between the anterior canthus of the same. Inner and outer nares the same distance apart. Greatest width of head 5.5 to 6 times in length from end muzzle to groin, five sevenths length from chin to gular fold. Canthus of mouth behind canthus of eye. A series of pores along the superciliary, which pass round the orbit behind and below; a scattered longitudinal series on the parotoid region, and a transverse aggregation of the same on each side below parotoid groove; a single series of the same for a short distance inside the ramus of the mandible. The parotoid region possesses a thin stratum of dermal cryptæ.

Costal folds 12; the anterior is a little distance behind the axilla. Toes subcylindric, similar to that of the *A. jeffersonianum*; in one specimen (type) they are separated by nearly an intercostal space when the limbs are pressed to the sides; in another they meet. Tail rounded above at base, finally much compressed, but not elevated, equal, in one specimen body and head to middle orbit, measured from posterior extremity vent. In the type, however, it is much shorter, extending from its basis only to the eighth costal fold (from groin), but I am not sure that this is normal.

Color leaden, in type paler below with numerous indistinct whitish blotches. Eye lids yellowish margined. Sp. 4688 has the abdomen darker and without spots.

| No. | Locality. | Donor. | No. Sp. |
|------|------------------|-----------------------|---------|
| 7145 | Cleveland, Ohio. | Prof. J. P. Kirtland. | 1 |
| 4688 | Unknown. | Prof. Agassiz. | 1 |

The narrower head and more elongate body will distinguish this species from the *A. jeffersonianum*. It is readily distinguishable among many individuals, nevertheless many of those of the var. *lateralis* approach it in the proportions of the parts of the head to each other. These points are the closer approximation of the eyes and of the nostrils. The shorter body is, however, always preserved. The size of the *lateralis* is considerably less. Those of the typical var. of the same species are invariably stouter, not only in body but head.

AMBLYSTOMA MACRODACTYLEM Baird.

Journ. Ac. N. Sci. Phila. i. p. 292.

This species is the slenderest of all our species of *Amblystoma*, in this respect as well as length of digits exceeding even the *A. jeffersonianum*.

The specimen before me is too small to furnish any reliable indication as to the character of the glands, and pores of the skin. These are probably much as in *A. jeffersonianum*. No pores are visible on the head arranged in regular patterns.

The head is rather large, depressed and elongated, with a moderate constriction at the neck. The eyes are prominent and distant less than two lengths of the orbit. The outer and inner nostrils are each about one orbit distant. The width of the head is about three-quarters the distance to gular fold.

The tongue is oval and longitudinal. The palatine teeth are in three or four patches, the central largest, occasionally separated by an interval less than half the diameter of the inner nostrils; together they form a line, slightly angular anteriorly, where they reach to about opposite the centre of the inner nostrils; laterally they pass a little the outer margin of the inner nostrils.

[Dec.

The body is cylindrical-depressed, with twelve costal furrows. The tail is broken; but from what is left appears to be somewhat compressed, but much rounded.

The color in alcohol appears to be brown with a well defined broad dorsal stripe of grayish brown, which involving the whole upper surface of the head and neck contracts on the nape, swelling again on the back, with an average breadth of the outer orbital space; this stripe seems to extend to the end of the tail. On each side of this dorsal stripe is a suffusion of dark brown which gradually pales through the color of the sides into the belly; there are also a few spots of the same in the dorsal stripe. There are a few grayish white dots scattered along the sides, and perhaps on the limbs.

Two specimens (4054) from Puget Sound, agree in form with the preceding specimen; the two central patches of palatine teeth perhaps a little more angularly arranged. Instead of the grayish dorsal stripe, however, there is a brownish red one, and the sides are of a darker and more continuous brown. No. 4711 has a similar character of palatines but a coloration more like the type. The palatines in fact extends a little in front of the anterior border of the inner nostrils.

Proportional Dimensions of 4042.

| | |
|--|------------------------|
| Length of gape of mouth, to its width..... | two thirds. |
| Width, "to distance from snout to gular fold | about $\frac{7}{8}$. |
| " " " groin | 5 times. |
| From snout to gular fold, contained in distance from snout to groin..... | $3\frac{1}{2}$. |
| Distance anteriorly between eyes, in length of orbit..... | less than 2. |
| " between external nostrils..... | one orbit. |
| " " internal..... | " |
| Free portion of longest finger contained in distance from elbow to tip..... | about $2\frac{1}{2}$. |
| Free portion of longest toe contained in distance from knees to tip..... | $2\frac{1}{2}$. |
| Distance between outstretched toes in length from snout to groin..... | about equal. |
| Number of costal furrows (including axillary and inguinal).... | 12. |

Measurements.

| | |
|--|------------|
| Length (measured along axis of body) from snout to gape..... | 20 |
| " " " gular fold..... | 44 |
| " " " armpit..... | 65 |
| " " " groin..... | 1.50 |
| " " " behind anus..... | 1.82 |
| " " " end of tail..... | broken |
| Width of head..... | .30 |
| " tongue..... | .17 |
| Length of orbit..... | .12 |
| Distance between eyes anteriorly..... | .20 |
| " " outer nostrils..... | .12 |
| " " inner nostrils..... | .12 |
| " " armpit and groin..... | .90 |
| Height of tail where highest..... | .18 |
| Free portion of longest finger..... | .15 |
| From elbow to tip of longest finger..... | .39 |
| Free portion of longest toe..... | .20 |
| From knee to tip of longest toe..... | .50 |
| Distance between outstretched toes..... | 1.40 |
| Total length of a larger specimen..... | 4 in. 4 l. |

1867.]

| Cat. No. | No. of Spec. | Locality. | From whom received. |
|----------|--------------|--------------------------|---------------------|
| 4042 | 1 | Astoria, O. | Acad. Nat. Science. |
| 4711 | 1 | Simiahmoo. | A. Campbell. |
| 4054 | 2 | Puget Sound. | Dr. Suckley. |
| 4035 | 2 (larva) | Wash. Terr. (Aug. 1.) | Dr. Cooper. |
| 5982 | 14 | Chiloweyuck Lake, Or'g | Dr. C. B. Kennerly. |
| 5248 | 1 | Walla Walla, Ft. Benton. | Lt. Mullen. |

AMBLYSTOMA PAROTICUM Baird.

Spec. nov.

This Salamander is of very peculiar character. It is one of the stout-bodied species, in this respect about equal to *A. punctatum*, but with a broader head.

In the type specimen (4708) the skin is remarkably free from pits, pores and milk glands. These are found on the parotid region, both above and below the horizontal furrow from eye to side of neck, which is swollen in consequence. There is also a small patch on top of head, bordering the orbit; a patch on the spaces between the intercostal furrows, on the upper part of the sides, extending, though faintly, nearly to the belly. Along the ridge of the tail, bordered below by an indented line, the glands are thickly crowded. A few scattered glands are seen along the back. Elsewhere the skin is perfectly smooth and glandless, with the muscle directly beneath it, although probably when fresh the usual shallow pits of the group stud the skin thickly everywhere, as usual. These are distinctly visible in a second specimen, 4709. In this, also, the glands are more numerous on the back, and extend farther down the side of the tail.

The head is broad and depressed; considerably constricted at the neck. The eyes are unusually large and prominent for the genus; separated anteriorly by about twice the length of their orbits; distant from the nostrils less than this length. The outer and inner nostrils are respectively about equidistant by little more than one length of the orbit.

The tongue is moderate, nearly orbicular, filling the rami only anteriorly, and hardly more than half the width of the head.

The teeth are in four patches, forming a transverse series, slightly angular anteriorly, where they extend to about opposite the centres of the inner nostrils. The two central patches are rather the larger, with a slight interval. They extend postero-laterally nearly to the inner margin of inner nostrils; these are separated from the outer patches by an interval nearly the width of the inner nostrils. The lateral patches extend a short distance beyond the outer margin of the inner nostrils. The sphenoidal portion of the roof of the mouth is much restricted laterally and behind.

The body is full, rounded and depressed; there are eleven costal furrows, including inguinal and axillary.

The tail is compressed, but oval in cross section, with the lower edge rather sharp towards the end; the upper outline is much rounded. It is not high, and not as long as the rest of head and body; longer than from snout to groin. In one specimen there is a distinct furrow along the under side.

The limbs are large; the digits lengthened, more depressed than in *A. punctatum*, but linear, not triangular in shape. The lateral ones are more lengthened than usual, and those of each limb are more nearly of a length. The free portion of longest finger is more than one-third from tip to elbow; that of longest toe in the same proportion.

The gape of the head is wide; the length more than half the width. The width of the head is contained four times in distance from snout to groin.

The color in one specimen is everywhere a dull reddish olive or brown, paler beneath, and without the trace of any spots. No. 4707 is much darker—nearly black.

The *Amblystoma trisruptum* Cope, from Ocate Creek, is similar to the

[Dec.

present species in the intervals between the four palatine patches and the glands on the parotid region. The rest of the skin, however, as far as can be ascertained, is glandular, as in *A. punctatum*, *tigrinum*, etc. The digits, too, are shorter, flatter, more irregular, the lateral and central more unequal; the eyes are much smaller and farther apart; there are 12 costal furrows, not 11, etc.

Proportional Dimensions.

| | |
|---|-------------------|
| Length of gape of mouth, to its width..... | more than half. |
| Width, to distance from snout to gular fold..... | cont. 1½ |
| groin | 4½ |
| behind anus..... | +5 |
| From snout to gular fold, contained in distance from snout to groin | 3½ |
| behind anus | +4 |
| Distance anteriorly between eyes, in length of orbit..... | 2 |
| from eyes to nostrils.... | little over 1. |
| between external nostrils..... | " 1. |
| internal nostrils | about 1. |
| Width of tongue to width of head | little over half. |
| Free portion of longest finger contained in distance from elbow to tip | 2¾ |
| Distance between outstretched toes in length from snout to groin | equal. |

Measurements.

| | | | |
|--|--------------|------------------------------|---------------------|
| Length (measured along axis of body) from snout to gape..... | .50 | | |
| gular fold | .95 | | |
| armpit..... | 1.50 | | |
| groin | 3.10 | | |
| behind anus..... | 3.80 | | |
| end of tail..... | 7.20 | | |
| Width of head | .75 | | |
| tongue | .40 | | |
| Length of orbit..... | .25 | | |
| Distance between eyes anteriorly..... | .45 | | |
| outer nostrils..... | .25 | | |
| inner nostrils..... | .24 | | |
| Height of tail where highest..... | .45 | | |
| Breadth " " | .20 | | |
| Free portion of longest finger..... | .30 | | |
| From elbow to tip of longest finger | .83 | | |
| Free portion of longest toe..... | .35 | | |
| From knee to tip of longest toe..... | 1.00 | | |
| Distance between outstretched toes | 3.05 | | |
| Cat. No. | No. of Spec. | Locality. | From whom received. |
| 4708 | 1 ♀ | Chiloweyuck, W. T. (1859) | A. Campbell (type). |
| 4708 | 2 | Near Simiahmoo. | " |
| 6634 | 1 | Coal mines of Vancouver Isl. | Alden W. Hewson. |
| 7021 | 1 | Puget's Sound. | Dr. Kennerly. |

AMBLYSTOMA ATERRIMUM Cope.

Sp. nov.

This is a stout species, having a form of head intermediate between that of the *A. tenebrosus* and *A. mavortius*. The dentition is quite peculiar, and with the ensemble of its characters, refers it to the immediate neighborhood of the *A. tenebrosus*.

Head a broad oval; its greatest width a little over $\frac{1}{2}$ the length from end muzzle to gular fold, and 4.2 in same to groin. The pupil marks three-sev-1867.]

enths the distance from canthus of mouth to external nostril. Fissure orbit equal length from same to nostril, and enters 1.66 times width between the latter; it is contained 2.25 times in width between anterior canthi of eyes. Canthus rostralis marked at orbit, terminating very obtusely at nostril; the profile descends steeply from line of latter, not being prolonged as in *A. tenebrosus*. Thus from the line connecting middle of inner nares to lip is .75 external internarial distance, and .6 between anterior canthus of eyes; in *A. tenebrosus*, same equals internarial width, and .75 the distance between eyes. The distances between inner and outer nares are the same; the former are round. The series of palatine teeth commence only opposite the middle of the posterior margin of the internal nares, and describe a slight curve round their inner margins to a point just in advance of their anterior, then turn abruptly inwards and slightly backwards, making a right angle with their previous course; they converge but do not unite.

Tongue large, as broad as long. Gular fold well marked; parotid groove not visible, perhaps accidentally. It is difficult, as in the *A. tenebrosus*, to distinguish the costal folds; there are not more than 12.

The tail is short and stout; its upper edge is much compressed, as is the posterior half; its glandular structures are much less developed than in other species of *Amblystoma*, the crypts of the crest being minute and globular. Length of tail equal from its origin (posterior margin vent) to posterior outline of sternum.

The extremities are very stout, just meeting when laid along the side. The palms and soles are very wide, and the toes short and flattened; they stand, as regards length, behind 3-4-2-5-1; before 3-2-4-1.

The color is black above, lead-colored below.

| | In. | Lin. |
|---|-----|------|
| Length from snout to gape (flat proj.)..... | 7 | 1 |
| gular fold | 12 | 7.5 |
| axilla..... | 19 | 1 |
| groin | 39 | |
| end of vent..... | 48 | |
| end tail | 6 | 6. |
| Width of head..... | 9 | 7.5 |
| tongue..... | 5 | 2 |
| between eyes anteriorly..... | 5 | |
| nostrils..... | 4 | |
| inner nostrils..... | 3 | |
| from eye to nostril..... | 2 | 2.5 |
| Circumference belly | 23 | 6 |
| Greatest height tail..... | 5 | 4 |
| width | 4 | 5 |
| Free portion longest finger..... | 2 | 5 |
| From elbow to tip of do. | 9 | 7.5 |
| Free part longest toe..... | 3 | |
| Knee to tip of do. | 11 | |
| Extent of outstretched toes..... | 3 | 3.1 |

No. 5242. From North Rocky Mountains. Lieut. Mullen.

AMBLYSTOMA TENEBROSUM Baird and Girard.

Pr. A. N. S. Phila. 1852, 174. U. S. Exp. Ex. Rept. p. 14, Tab.

This species forms the type of a special section of the genus, differing as it does from all other *Amblystomata* of North America. It is especially characterized by its massive frame and huge size among true Salamanders, as well as by other peculiarities hereafter to be mentioned.

The corrugation of the skin prevents any critical examination of its character in respect to glands, pits, etc. It is certainly less glandular than in *A.*

[Dec.

punctatum or *luridum*, although scattered glands may be detected closely and evenly distributed on the whole back and sides and on the chin: the remaining under parts and snout before the eyes are smooth.

The head is very massively built; large; broadest behind the eyes and triangular; the sides being nearly straight to the narrow and rounded tip. The eyes are very large and prominent, separated by less than two lengths of the orbit, and distant less than one length from the outer nostrils, which are separated by $1\frac{1}{2}$ orbits distance, and placed on the side below the distinct canthus rostralis. The outer nostrils are much more distant than the inner, which are very large, much excavated and have the external canal occupied by a soft plaited membrane.

The tongue is thick and fleshy, nearly orbicular; but angular anteriorly. It fills up the lower jaw pretty well, and is more than half the width of the head.

The palatine teeth are in two patches only; each very slightly convex anteriorly, coming together at a slight angle with the apex backward, but separated along the median line. Laterally the patches of teeth form the posterior margin of the inner nares, and do not extend beyond their outer margin. The entire series is thus posterior to the nostrils. In younger specimens the series are more transverse, the inner extremities slightly incurved.

The width of the head is contained $1\frac{1}{2}$ times in distance to gular fold, and 4 times to groin.

The body is rounded and depressed. There are 12 costal furrows.

The tail in the two specimens before me is considerably less than half the total length. It is much compressed from near the base, and the edges near the end are quite sharp. It is far short of being as deep at the base as the body.

The limbs are stout; the digits, the fingers especially, are short, considerably depressed, but linear and blunt at the tip; the under surfaces of these are somewhat swollen into a kind of bulb, which in alcohol contracts into something the appearance of a disk. The third finger is longest, but is very little more than the 2d, and this than the 1st and 4th. The third finger is contained nearly 4 times in the distance from elbow to tip. The 4th toe is longer than 3d in three specimens, in one the 3d exceeds the 4th a little, and the same are nearly equal in case of the fingers.

The color of this species in alcohol is a kind of dark reddish-brown, pale beneath, mottled and marbled above and on the sides with darker brownish; most distinct on the head, especially on the snout, where the skin is perfectly smooth. The head shows a tinge of greyish in the ground color.

(For fresh color see the figure in Girard's Herpetology of the United States Exploring Expedition.)

There are two varieties of this species :

a. Where the loreal region is flat and the muzzle narrower before the orbits, and the marblings confined to the head; the body being of a nearly uniform brown; represented by specimens 4710 and 4053.

β. The loreal region swollen in front of orbits, and hence the muzzle broader: the ground color greyish, with coarse brown marbling, like large hollow spots, distributed over the whole upper surfaces of the body and tail. Represented by No. 5981, and a large specimen (length 8 in. 6 lin.) in Mus. Academy Nat. Sciences, from Body Bay, lat. 38° 18' N., on the coast of California, procured by our esteemed correspondent, George Davidson.

Proportional Dimensions.

| | |
|---|-----------------------------|
| Length of gape of mouth, to its width..... | 3 |
| Width contained in distance from snout to gular fold..... | 1½ |
| groin..... | 4 |
| From snout to gular fold, contained in distance from snout to groin..... | little over 3 times. |

1867]

| | |
|---|------------------|
| Distance anteriorly between eyes, in length of orbit..... | not quite twice. |
| from eyes to nostrils..... | four-fifths. |
| between external nostrils..... | 1½ |
| internal..... | four-fifths. |
| Width of tongue, to width of head..... | ½ |
| Free portion of longest finger contained in distance from elbow to tip..... | nearly 4 times. |
| Free portion of longest toe contained in distance from knee to tip..... | " 3½ " |
| Distance between outstretched toes in length from snout to groin..... | 1½ |
| Length of tail from behind anus, to rest of animal..... | contained 1½ " |
| total length..... | two-fifths. |

Measurements.

| | |
|--|------|
| Length (measured along axis of body) from snout to gape..... | 80 |
| gular fold..... | 1-50 |
| armpit..... | 2-10 |
| groin..... | 4-55 |
| behind anus..... | 5-65 |
| end of tail..... | 9-30 |
| Width of head..... | 1-15 |
| tongue..... | 60 |
| Length of orbit..... | 34 |
| Distance between eyes anteriorly..... | 58 |
| outer nostrils..... | 40 |
| inner nostrils..... | 30 |
| from eye to "..... | 26 |
| Circumference of belly..... | 4-00 |
| Distance between armpit and groin..... | 2-65 |
| Height of tail where highest..... | 65 |
| Breadth do..... | 36 |
| Free portion of longest finger..... | 28 |
| From elbow to tip of longest finger..... | 1-05 |
| Free portion of longest toe..... | 36 |
| From knee to tip of longest toe..... | 1-35 |
| Distance between outstretched toes..... | 3-60 |

| Cat. No. | No. of Spec. | Locality. | From whom received. |
|-----------|--------------|-------------------|-------------------------------------|
| 4710 | 1 | Oregon. | Ex. ex. (type). |
| 4053 (34) | 1 | Mo. of Columbia. | Lt. Trowbridge (spec. desc. above). |
| 5981 | 1 | Chiloweyuok Lake. | Dr. C. B. Kennerly. |

AMBLYSTOMA TEXANUM Baird.

U. S. Mex. Bound. Survey, ii. Reptiles 27 Tab., xxxv. 15. *Salamandra texana* Matthes, Allg. Deutsche Nat. Zeitung i. 266, 1855.

The description of this species is taken from specimens which are not fully grown; the proportions are, however, much those of the *A. microstomum* at the same age; this with the large number of costal grooves renders it almost certain that the full grown individuals are much like those of the latter species, and very probably of near the same size.

Skin everywhere quite smooth, no trace of pores on the head or parotoid region in many specimens. Costal folds fourteen, distinct; head folds slightly marked, the gular slight. A median dorsal groove.

Head oval, rather flattened and broad, canthus rostralis somewhat marked. Mouth large, canthus behind eye, anterior canthus of latter marking middle of margin. Nostril a little nearer eye fissure than length of latter, probably equal in older specimens. Width between anterior canthus of eye double

[Dec.

length of fissure; external separated by one length of same, which is less than the distance between inner nares.

Tongue small as in other young, but not fissured or grooved as in those of the two following *Amblystoma*. Palatine teeth forming an arched series between nares extending to their anterior border, and not beyond their inner border in the lateral direction. From their resemblance to those of *A. microstomum* of the same age I suspect they are similar in old individuals.

Body rather slender; width of head at jaws four times in total length to groin and .75 length to gular fold. Tail short, longer when older, equal from its basis to axilla. Limbs moderately stout, digits elongate, third and fourth toes nearly equal, then 5th, 2nd, 1st. Fingers 3, 2, 4, 1.

Above light brown, with a series of light spots along upper part of sides; these are small and one between each pair costal fold. Sides and belly yellow.

| | In. | Lin. |
|--|-----|------|
| Length end muzzle to canthus oris..... | | 2.6 |
| to axilla..... | | 6.5 |
| to groin..... | | 14. |
| to end tail..... | 2 | 3.75 |
| elbow to end finger..... | | 3.1 |
| knees to end toe..... | | 3.7 |

| Mus. No. | No. Specimens. | Locality. | Collector. |
|----------|----------------|---------------------|---------------|
| 4044 | 11 | San Antonio, Texas. | J. D. Graham. |

The plane front and canthus rostralis of this species form a resemblance to the *A. tenebrosus*, between which and *A. microstomum* it is naturally placed.

AMBLYSTOMA CINGULATUM Cope, sp. nov.

This species approaches the *A. microstomum* in general, but may be readily known by its more elongate ovoid head, with long muzzle, more slender form of body and peculiar coloration.

Mucous crypts and pores are not much developed in this animal, a few only of the latter extend along the superciliary region. The costal folds are visible across the abdomen.

The head is elongate, convex both transversely and longitudinally; the upper face of the muzzle is narrowed, and projects beyond the mandible. The width at the jaws enters the length to the groin six and a half times, and one and three-fourths to the edge of the gular fold. The external nares are quite close together, nearer than the long diameter of the eye, and nearly 1.5 this diameter in advance of the eye. The anterior angles of the latter are 2.33 diameters apart. The folds on the side of the head and neck are as in other species. The distance between the inner nares is 1.66 times the distance between the external.

The tongue is oval, quite elongate, but not filling the space between the rami of the mandible; its median groove strongly marked. The palatine teeth are in a single row slightly convex forwards, entirely between the inner nares, their posterior margins of the ends of the series and nares corresponding. The gape of the mouth is short, but longer than in *A. microstomum*; its external canthus falls anterior to the posterior canthus of the eye, while the anterior canthus of the same measures the posterior third of the gape, commencing at the middle of the premaxillary region.

Costal grooves fourteen; a median dorsal groove strongly marked. An unusually strong fold across between angles of mandible, which sends a branch to the orbit; gular fold continued on neck, sending a parotoid groove forwards. Length to gular fold 3.75 in length to groin.

Length of tail nearly equal from basis of same to the mental cross fold. It is of rather uniform depth, much compressed, keeled above and for its distal half below. General form of the body slender and compressed, elevated at the scapular and pelvic regions.

1867.]

Limbs stout, the fingers slender but not very elongate. Appressed to the sides they fail of meeting by the length of the sole and longest toe; length from tip to tip when outstretched .66 length to groin. Length of lower leg and foot scarcely .8 from muzzle to gular fold. No visible plantar tubercles. Fourth toe distinctly longer than third, then 2, 4, 1. Fingers 3, 2, 4, 1.

Color in alcohol black, the under surfaces thickly speckled with grey. A vertical narrow grey line passes between every pair of costal folds and meets its fellow on the dorsal line or bifurcates to meet a similar bifurcation in like manner, embracing an area. These narrow annuli extend nearly as far forwards as the orbits and surround the tail to its extremity. Muzzle black.

| | In. | Ln. |
|---|-----|------|
| Total length..... | 3 | 6. |
| Length to canthus oris (straight) | | 2.25 |
| gular fold..... | | 6. |
| groin | | 18.7 |
| Width of head..... | | 3.1 |
| above femora..... | | 2.25 |

The shades of coloration in this creature are those of the *A. opacum*, but are differently arranged.

No. 3786; 1 spec. Grahamville, S. Ca. Bailey.

AMBLYSTOMA MICROSTOMUM, Cope.

Proc. Ac. Nat. Sci. Phila., 1861, p. 123. "*Salamandra porphyritica* Green," Hallowell (not of Green), hinc *Amblystoma porphyriticum* Hallowell. Proc. A. N. Sci. 1856, p. 8.

This species is among the most slender of American *Amblystomata*, and has other peculiarities by which it is readily recognizable. The skin is very smooth and slippery, with the glands less evident in the skin than in *A. opacum jeffersonianum*, etc. The skin is everywhere covered with small shallow pits only visible when the mucus is removed, which shows the tail to be sometimes conspicuously granulated, the granules probably corresponding to the ends of the glands. There are no evident pores or pits of larger size than the others on the head and parotids as in some *Amblystomata*.

The head is very small, narrower than the body, with little or no constriction at the neck. It is contained about six and a half to seven times in the distance to the groin. The head is much arched in every direction; the eyes far forward and lateral. The lower jaw projects a little beyond the border of the upper, concealing the latter when viewed from above. The eyes are distant, less than the length of the orbit from the nostrils; their anterior extremities separated by one and a half times this unit. The nostrils are one orbit length apart. The anterior edge of the orbit falls opposite the middle of the gape, instead of in its posterior third, as in *A. jeffersonianum*. The gular fold is distant from the snout one-fifth the distance to the groin.

The body is slender for the genus. There are fourteen costal furrows, including the inguinal and axillary. There is a slight indication of a dorsal groove posteriorly.

The tail is about two-thirds the head and body. It is nearly cylindrical at base; then becoming slightly compressed, more and more so to the tip, where it is quite flat, but without crest, although the edges are sharp. Viewed from the sides, there is a constriction at the base of the tail; this is one-fourth higher in the middle than at the base.

The limbs are weak, the digits are, however, rather long, cylindrical depressed, without membrane. The proportions of the digits as in *A. punctatum*. The longest finger is not one-third the fore arm; the longest toe is a little more than one-third the leg from knee. The outstretched hind legs are about two-thirds the head and body to groin.

The tongue is thick, fleshy and attached, although slightly free at sides and

[Dec.

tip. There is a longitudinal groove in the tongue, separating the two papillose portions of an oval shape placed side by side. This has not been observed in *jeffersonianum*. The pappillæ form parallel series on each oval oblique to the central groove with the edge of the tongue projecting beyond them.

There are only two patches or lines of palatine teeth. These occupy the middle of the palate, forming a Δ , the angle anterior and reaching as far forward as the anterior border of the inner nares; the postero-external ends do not pass the inner margin of these nares (in the soft palate, the proportions being a little different in the skull.)

Sometimes these two patches form nearly a straight line; or at least the central portion is straight, the lateral bending slightly backwards.

The color in alcohol is a dark brownish black, a very little paler beneath, and thickly and irregularly sprinkled on the sides with plumbeous spots about the size of the eye of no definite outline. These are less numerous above and below. Sometimes nearly wanting—sometimes they are larger than as described and look not unlike patches of a grayish lichen growing on the sides.

| | |
|--|------|
| 4096 (1.) Length (along axis of body) from snout to angle of mouth.... | 20 |
| gular fold..... | 45 |
| groin..... | 2.20 |
| behind anus..... | 2.50 |
| tip of tail..... | 4.00 |
| of tail..... | 1.50 |
| Width of head..... | 31 |
| Fore arm from elbow..... | 40 |
| Leg from knee..... | 46 |
| Expanse of hind legs..... | 1.45 |

The total length of largest specimen seen (3999 St. Louis) is six inches, of which the tail forms 2/60. The smallest adult is two inches long.

In the just perfected young is seen a series of larger ill-defined light spots than elsewhere along each side of the back. The belly is quite light colored.

This species bears a close resemblance to *Plethodon glutinosus*, for which the generic peculiarities, the longer digits, etc., readily distinguish it. The bluish spots too are much less sharply defined and duller, less silvery, and do not occur on the back, as in *glutinosus*, to anything like the same extent. From *A. jeffersonianum* it will be known by the projecting lower jaw; much smaller and more arched head, greater number of costal furrows, more evident spots on the sides, etc., besides the important peculiarities of tongue and teeth.

This is one of the species whose metamorphosis is completed some time before it attains full size. A specimen in which minute stumps of the branchiæ remain measures 2 in. in length; another, without traces of them, 2.15 in. The width of the head enters the length to the groin 4.2 times, and the tail falls short of the axilla from its base. These measurements may be compared with those of the adult, in illustration of the general principle that the relative lengths of body and tail increase with increased size.

| Cat. No. | No. of Spec. | Locality. | From whom received. |
|----------|--------------|------------------------|-----------------------------|
| 4096 | 30 | South Illinois. | R. Kennicott (spec. descr.) |
| 3902 | 4 | New Madrid, Mo. | " |
| 4001 | 2 | Lancaster, Ohio. | L. Lesquereaux. |
| 3995 | 3 (2 larv.) | Columbus, " | " |
| 3999 | 2 | St. Louis. | Dr. Engelman. |
| 4037 | 1 | Fort Smith, Ark. | Dr. G. C. Shumard. |
| 3884 | 5 | Prairie Mer-Rouge, La. | J. Fairie. |
| 4687 | 2 | Grand Coteau, La. | St. Charles College. |
| 3949 | 6 (juv.) | New Madrid, Mo. | R. Kennicott. |

1867.]

In concluding the review of this genus I wish to criticise the following remarks, published by F. P. Pascoe in Proc. Zool. Soc. London, 1866, p. 223:

"With many naturalists I believe the idea still remains that every genus must have certain definite structural peculiarities, and they appear to expect that broadly dividing lines shall run between them. Any confession that no absolute or primary characters exist, or that they are only secondary, is taken by them as a fatal proof of the weakness of the position. It is true that, owing to the more or less exceptional isolation of many genera, a very clear and decisive description may be given of them; but then it can never be said how soon the discovery of another form or species may upset the characters we have drawn from our limited number of examples, or whether the new genus or species may not be other sex of some other species. Moreover there are many natural assemblages of species, whether we choose to call them genera or not, for which no technical characters can be found, their connection depending partly on peculiarities which it is scarcely possible to convey an adequate idea of in words, partly on such gradual modifications of characters that no satisfactory line can be drawn between them, but which are, notwithstanding, not less real or striking. Those who only select a few prominent forms for description may demur to this; but any one who has gone conscientiously through a large collection will acknowledge how difficult it is in many instances to say if genera really exist, even as a collective term for any limitable number of species, and how unsatisfactory is any attempt to combine species into genera, or individuals into species, or to distinguish hybrida from what we conventionally call true species. It will therefore be readily understood that many genera can only be vaguely defined, either from the absence of salient characters, or from their gradual modifications; and some of the most natural groups among the Coleoptera might be cited as examples of these classes. To argue that genera ought to be ignored, when not strictly defined, would, in entomology, be to make classification impossible; to say that recognized genera should be enlarged from time to time to admit aberrant forms would be merely to create repertoires of incongruous species."

When we read "that genera can only be vaguely defined, from the absence of salient characters or their gradual modification," it is evident that there is a contradiction in terms, or that a new definition of a genus has been adopted. Are scientific men prepared to accept the above definition of a genus? We suspect not, for with it the translation of the natural system becomes merely empiric, and that exactitude which characterizes nature vanishes from its written counterpart. A genus, in our estimation, is a series of species distinguished from all other species by one or more structural characteristics, which are not variable in the reproducing adults of that series, or of any other series of species, *not otherwise distinguished*. A genus so defined constitutes one, or most frequently several series of species, bearing a successional relation to each other, which may differ widely in general appearance, coloration, etc., and which are frequently mistaken by zoologists for genera. They are "the assemblages of species, which are not less real or striking," to which our author alludes. I would correct the allusion by calling them assemblages of species which are less real, though not less striking.

An error of this kind, or else a want of exhaustive investigation of structure, most probably a combination of both, has no doubt led to the opinions I have quoted above. A rigid classification of characters into essential and non-essential, is what our science everywhere needs. But taking the opposite course, written zoology becomes a panorama rather than an analysis. Were the principles of classification employed by some authors to be applied to domesticated animals, its errors would be obvious to every one.

The genus occupying the preceding pages is an illustration in point. Had the author adopted the various supposed species and genera described

[Dec.

which it includes, he might have readily been brought to the necessity of according with the views above quoted. But a correspondence with nature has required the recognition of *protean* species, as in a higher grade of characters we are compelled to recognize *protean* genera. These groups are, perhaps, those in which, respectively, certain characters are, for the time being, undergoing a transition, which transition may at some period cease.

The serial relation of species has been above alluded to. This is far less obvious, however, than the serial relation of genera. This does not, however, interfere with the entire isolation of the latter from each other as regards any single geologic period, considered by itself. The naming of groups of species which do not present this isolation, though prevalent in some branches of zoology, is, in our estimation, a violation of the meaning of the name genus, and very disadvantageous to science. It is, of course, of no consequence to science whether a genus contains one or a thousand species, and for the student they can be as well classified and characterized in the latter case as the former. In the multiplication of names a new burthen is imposed—but what shall we say when these come to apply to something “vaguely defined,” or “for which no technical description can be found”!*

II. Species of *AMBLYSTOMA* unknown to the writer.

Amblystoma punctulatum Gray, Catal. Batrachia Gradientia, Brit. Museum, 37, 1850.

Said to be from Monterey, California. The description is too brief to enable us to recognize or place it.

III. Descriptions of two new Pacific species of *PLETHODON* Tsch.

PLETHODON INTERMEDIUS Baird.

This new species, in general appearance, proportions of body, etc., is very similar to *P. erythronotus*, although abundant differences are easily discoverable. The body, as in *erythronotus*, is slender and depressed; the tail, as far as indicated by the portion still remaining, is slightly compressed.

There are no apparent peculiarities about the head. The tongue is elongated, elliptical, without posterior emargination. There are 14 costal furrows, or perhaps 15, if we include one above the axilla. The distance from snout to axilla is contained rather less than three times in that to groin.

The digits are well developed; more as in *P. glutinosus*. There is little if any indication of web at their bases; the three terminal phalanges of the 3d and 4th toes being free. The 2d and 4th toes are about equal. The outer toe is not more than half the 2d; the 1st finger and toe are almost rudimentary. The 3d finger is decidedly longer than the 2d.

The dorsal surface of this species is traversed by a broad brownish-red stripe, extending from the nape to the end of the tail, the sides regular and nearly parallel, though more separated towards the middle of the back, where it is as wide as the interorbital space. The stripe is sparsely dotted with dusky throughout its extent. The sides are abruptly blackish-brown on each

* Another example of this mode of procedure may be found in a classification of the Crocodilia, by Dr. Gray, in the Trans. Zool. Society, London, 1867, which only needs to be read to explain the applicability of the above remarks. The absence of all contrast in many of the generic tables is because they do not exist as such in nature.

It may be added in this connection that the writer omits dates of publication of the names of the genus *Osteolemus* Cope, the latter having over a year priority over *Haicrora* Gray, the name adopted. He calls the species *H. nigra* from the *Crocodilus niger* of Latreille, H. N. Rept. page 210 (not 510, as given by Gray), a species based on the MS. notes of Adamson, with the only description that it is black, and that its jaws are longer than those of the *Crocodilus* of the Nile. Should such a description be sufficient to establish a species, which we greatly doubt, it is enough to indicate its inapplicability to this present one, that the jaws of the *Osteolemus tetraspis* are always much shorter than those of the *Crocodilus vulgaris*, a fact readily determined by reference to Dr. Gray's essay itself.

side the dorsal stripe, at first continuous, but becoming more and more interrupted by mottling. The belly is light brownish-yellow, thickly mottled with dark brown in about equal proportions; tightest under the chin. There is a dusky line from the eye to the point of the muzzle.

The general proportions and structure of this species are more those of *P. glutinosus* than of *erythronotus*, although slenderer of body. In both there are about 14 costal grooves. The outer digit in *intermedius* is nearly rudimentary instead of prominent, as in the other species.

A distinguishing feature, when compared with *cinereus* and *erythronotus*, is found in the 14 instead of 18 costal grooves, the fore and hind limbs being thus less widely separated proportionally. The legs are slender and the digits much less webbed (scarcely at all, in fact). The 3d and 4th toes, especially, are much longer.

Independent of the structural peculiarities I find nothing in the color to distinguish this species from *erythronotus*.

Measurements.

| | |
|--|------|
| Length (measured along axis of body) from snout to gape..... | 14 |
| “ “ “ “ gular fold | 45 |
| “ “ “ “ armpit..... | 65 |
| “ “ “ “ groin | 1.80 |
| “ “ “ “ behind anus..... | 2.15 |
| “ “ “ “ end of tail..... | 3.65 |
| tail..... | 1.50 |
| Width of head..... | .26 |
| “ tongue..... | .15 |
| Length of tongue..... | .24 |
| “ orbit..... | .09 |
| Distance between eyes anteriorly..... | .15 |
| Circumference of belly..... | .80 |
| Distance between armpit and groin..... | 1.25 |
| Height of tail where highest..... | .17 |
| Breadth do. | .16 |
| Free portion of longest finger.. | .07 |
| From elbow to tip of longest finger..... | .31 |
| Free portion of longest toe... | .11 |
| From knee to tip of longest toe..... | .37 |
| Distance between outstretched toes..... | 1.10 |
| Cat. No. No. of Spec. Locality. From whom received. | |
| 4732 1 Fort Tejon, Cal. J. Xantus (type of descr.) | |
| 6635 1 Coal mines, Vancouver Isl. Alden W. Hewson. | |

PLETHODON CROCENATER Cope.

The largest species of the genus, and one of the most ornamented of the American salamanders.

In primary features this species is near the *P. ensatus* (*Heredia oregonensis* Girard,) having the attachment of the tongue along the median line, quite narrow, and a very narrow free margin in front. The palatine teeth form two long transverse separated arcs, which are directed more posteriorly at their median than exterior extremity, the latter extending further outside the outer margin of the inner nares than the transverse diameter of the same. The tail is subcylindrical and slender, compressed and narrowed in section below. No prominent glandular agglomerations or pores. Only three phalanges in the fourth toe.

Form of head peculiar; it is very broad, with straight converging maxillary outlines and truncate muzzle. Upper surface much narrowed on muzzle, loreal regions plane, very oblique, canthus rostralis not marked. Maxillary outline obliquely spread at and behind orbits, where it is exceeded by the

[Dec.

projecting margin of the mandible. Anteriorly, with the end of the muzzle it projects considerably beyond mandible. Muzzle truncate in profile, a slight emargination at middle of premaxillary border, and a groove on each side of it on inferior projecting face of lip. Nares terminal some distance above the angulation of the lip, continued below in a groove which bifurcates near lip margin; the posterior line extending a short distance, the anterior to the median emargination separating the anterior from the inferior plane of the muzzle. Eye large, not very prominent, its anterior canthus well in front of middle of jaw, and separated one diameter from nostril, and 1.5 from the other eye.

No fold across from angle to angle of mandible, but the gular, parotoid and postorbital grooves well marked. Costal grooves indistinct, thirteen. Skin everywhere very smooth.

Tail longer than head and body by the length of the mouth. Width at curve of mandible 4.6 times in length to groin. Extremities slender and long; when pressed to the sides the fingers extend to the heel. Length of whole fore limb 2.75 times in length to groin. Inner finger very small, half the length of the fourth; third longer than second. Sole narrow, longer than the longest toes. Inner toe less than one half the fifth; third a trifle longer than fourth; second much longer than fifth. Lower leg .75 thigh to groin.

Patches of parasphenoid teeth two, in contact anteriorly, well separated from palatine. All the teeth minute, numerous, acute cylindro-conic. Tongue with rather straight lateral and posterior outlines.

Color throughout pitchy black, fading into bright red orange below; limbs orange, a blackish cross band below the knee. A large red orange spot on each parotoid region, and four smaller irregular similar spots on the body to base of tail, on each side of and near the vertebral line. A pair of orange spots at base of tail, and a distant series on the upper face of the tail.

Measurements.

| | In. | Lin. |
|---|-----|------|
| Length (measured along axis of body)..... | 5 | .11 |
| " From snout to gape, (on front)..... | | .5 |
| " " gular fold..... | | .8 |
| " " armpit..... | 1 | 0.75 |
| " " groin..... | 2 | 5. |
| " " centre of anal slit..... | | 4.5 |
| Width of head..... | | 6.75 |
| tongue..... | | 3.75 |
| Length of orbit..... | | 2.2 |
| Distance between eyes anteriorly..... | | 3.3 |
| outer nostrils..... | | 2.3 |
| inner nostrils..... | | 2. |
| Height of tail where highest..... | | 3. |
| Breadth " " "..... | | 2.5 |
| Free portion of longest finger..... | | 2.25 |
| From elbow to tip of longest finger..... | | 7.25 |
| Free portion of longest toe..... | | 2.75 |
| From knee to tip of longest toe..... | | 8.5 |
| Distance between outstretched toes..... | 2 | 4.4 |

One specimen. Fort Tejon, Cal. J. Xantus.

The only genus omitted from my examination of the families of Urodela* is *Anides* Baird. An examination of the skeleton shows that genus enters the *Plethodontidae* and is nearest *Plethodon*, but differs from it in having the mandibular teeth confined to the distal half, and exceedingly long and compressed, thus differing from all known *Urodela*.

* Journ. A. N. S. 1896.

FASTI ORNITHOLOGIE.

BY JOHN CASSIN.

Vain is it that your science sweeps the skies,
Each, after all, learns only what he can!

—Faust, Brooks' translation.

No. 3.

ENCYCLOPÆDIA LONDINENSIS, OR UNIVERSAL DICTIONARY, &c., &c.

Compiled, digested and arranged by John Wilkes, of Midland House, in the County of Sussex, Esquire; assisted by eminent scholars of the English, Scotch and Irish Universities. London, 1795 to 1829. 24 vols. quarto, many plates of Natural History.

The Natural History contained in this Encyclopædia is the basis of a work published separately, and apparently nearly simultaneously, much enlarged and popularized, and forming fourteen volumes octavo, with the following title:

"A genuine and universal System of Natural History, comprising the three Kingdoms of Animals, Vegetables and Minerals, arranged under their respective Classes, Orders, Genera and Species, by the late Sir Charles Linnæus, Professor of Physic and Botany in the University of Upsal, and President of the Royal Academy of Stockholm; improved, corrected and enlarged by J. Frid. Gmelin, M. D., Professor of Natural History in the Royal Society of Gottingen;

"Faithfully translated, and rendered more complete by the addition of Vaillant's beautiful Birds of Africa; the superb Fish of Mark Kleaser Bloch; the Amphibious Animals, Reptiles, Insects, &c., in the costly works of Albertus Seba, Merian, Fabricius, Knorr, &c.; the elegant improvements of the Comte de Buffon, and the more modern discoveries of the British Navigators in the South Pacific Ocean, New Holland, &c., &c.

"Methodically incorporated and arranged by the Editors of the Encyclopædia Londinensis." London, 14 vols. octavo, dated only on the plates. In these fourteen volumes there are 415 plates, colored, 162 of which represent birds. The greater part are in octavo form, and evidently engraved expressly for this work; the remainder are from the Encyclopædia, mainly (in birds) representing Le Vaillant's species, and are quarto, folded.

The Encyclopædia Londinensis contains nearly or quite the whole of Gmelin's edition of the *Systema Naturæ*, but perhaps rather more completely the zoological portion thereof, and in some genera of birds rather strictly according to the version of Turton. There are additions by the editor or editors, the most important of which, in ornithology, are the species given in the various works of Le Vaillant, a large number of which are named for the first time by any English naturalist or writer, and in some instances having the precedence over all others quite entirely. Daudin, Vieillot, Shaw and Latham are the principal competitors, and successfully so, in the large majority of species, but by very small figures; and with Vieillot there is a tie of date occasionally, as, for example, in the genera *Muscicapa* and *Motacilla*. The dates of publication (in the Encyclopædia) are easily determined, being engraved on every plate.

The names and the descriptions of birds in this Encyclopædia I have never seen quoted nor otherwise alluded to, by any author; an omission or oversight, as it seems to me, without sufficient reason, granting the doubtful presumption (though odd accident in this wide-awake age) that any writing naturalist or amateur ever saw them (except myself). There is no reason, I think, why the Encyclopædia Londinensis should not be regarded as quite equal in authority to the *Nouveau Dictionnaire* or the *Encyclopedie Methodique*, nor any possible impeachment of its respectability and grade of importance as a scientific work.

[Dec.

Who the editors were, in charge of the department of Ornithology, is more than I know; but perhaps some of the more intelligent of the English ornithologists can find out, if they think it worth while. An inquiry in "Notes and Queries" would bring it. John Wilkes, of the County of Sussex, Esquire, is printed on every title-page as the responsible editor throughout, and for the present, as he was presumably an entirely respectable person, I take him at his word, and hold him accordingly,—preferring, however, that it be distinctly understood and remembered that there was another of the same name (who did not concern himself with Encyclopædiaz, so far as I ever heard, but was in a much less creditable business). In a preface to Vol. I of the octavo work it is stated that "This comprehensive system of Natural History was begun by the late E. Sibly, M. D., who made considerable progress in it before his decease;" but it is not stated that he was at all engaged in the Encyclopædia. Nor is the exact amount of headway made by him discernible at present, I think, in either book.

In the octavo work, the fourth, fifth, sixth, seventh and eighth volumes contain the ornithology, in the first four of which all the birds of Gmelin's edition of the Syst. Nat. are given, with some additions from Pallas, Turton, Pennant and others, with copious notes and translations well written and readable. The last, that is the eighth volume, is exclusively devoted to Le Vaillant, and contains a translation of nearly the whole of his Ois. d'Afrique and numerous copies of his plates. The latter were given previously in the Encyclopædia, but the text is much enlarged, and apparently nearly a literal translation, while in the Encyclopædia, where the species are named, usually only a short abstract of Le Vaillant's text is given. There are not many better popular Ornithologies, yet extant, than these same volumes of this "Genuine and Universal System of Natural History," and they deserve favorable mention, at least, alongside of anything in that line in the English language yet produced.

The following is a list of the species of birds named and described in the Encyclopædia Londinensis, those names having priority and consequent claim, valid in equity, being given in small capitals. The numbers of the species are the same as given in numerical order in the Linnæan genera to which they belong (in the Encyclopædia):

List of Birds named and described as new (but often erroneously) in the Encyclopædia Londinensis, with synonyms and references to plates, and straightened out, in general, according to the ability of the present editor.

Genus FALCO.

2. *Falco griffardus*, Wilkes, Encyc. Lond. vii. p. 173 (1805).
Falco bellicosus, Daud., Traité d'Orn. ii. p. 38 (1800).
 Le Vaill., Ois. d'Afr. pl. 1. Encyc. Lond. vii. pl. 2.
3. *Falco caffre*, Wilkes, Encyc. Lond. vii. p. 173 (1805).
Falco vulturinus, Daud., Traité d'Orn. ii. p. 53 (1800).
 Le Vaill., Ois. d'Afr. i. pl. 6.
4. *Falco remex*, Wilkes, Encyc. Lond. vii. p. 174 (1805).
Falco ecaudatus, Daud., Tr. ii. p. 54 (1800).
 Le Vaill., Ois. d'Afr. i. pl. 7, 8. Encyc. Lond. vii. pl. 2.
41. *Falco stridens*, Wilkes, Encyc. Lond. vii. p. 178 (1805).
Falco vocifer, Daud., Tr. ii. p. 65 (1800).
 Le Vaill., Ois. d'Afr. i. pl. 4. Encyc. Lond. vii. pl. 4.
50. *Falco capillamentus*, Wilkes, Encyc. Lond. vii. p. 179 (1805).
Falco occipitalis, Daud., Tr. ii. p. 40 (1800).
 Le Vaill., Ois. d'Afr. i. pl. 2.

1867.]

51. *Falco longicaudus*, Wilkes, Ency. Lond. vii. p. 180 (1805).
Falco albescoens, Daud., Tr. ii. p. 45 (1800).
 Le Vaill., Ois. d'Afr. i. pl. 3. Ency. Lond. vii. pl. 4.
56. *Falco parasiticus*, Wilkes, Ency. Lond. vii. p. 181 (1805).
Falco parasitus, Daud., Tr. ii. p. 150 (1800).
 Le Vaill., Ois. d'Afr. i. pl. 22. Ency. Lond. vii. pl. 5.
63. *Falco rutilo niger*, Wilkes, Ency. Lond. vii. p. 183 (1805).
Falco jakal, Daud., Tr. ii. p. 161 (1800).
 Le Vaill., Ois. d'Afr. i. pl. 16.
64. *Falco rutilo-griseus*, Wilkes, Ency. Lond. vii. p. 183 (1805).
Falco desertorum, Daud., Tr. ii. p. 162 (1800).
 Le Vaill., Ois. d'Afr. i. pl. 17.
65. *Falco bacha*, Wilkes, Ency. Lond. vii. p. 184 (1805).
Falco bacha, Daud., Tr. p. 43 (1800).
 Le Vaill., Ois. d'Afr. i. pl. 15. Ency. Lond. vii. pl. 6.
66. *Falco manicatus*, Wilkes, Ency. Lond. vii. p. 184 (1805).
Falco plumipes, Daud., Tr. ii. p. 163 (1800).
 Le Vaill., Ois. d'Afr. i. pl. 18. Ency. Lond. vii. pl. 6.
67. *Falco maculatus*, Wilkes, Ency. Lond. vii. p. 184 (1805).
Falco tachardus, Daud., Tr. ii. p. 164 (1800).
 Le Vaill., Ois. d'Afr. i. pl. 19.
68. *Falco busurai*, Wilkes, Ency. Lond. vii. p. 185 (1805).
Falco busarellus, Daud., Tr. ii. p. 168 (1800).
 Le Vaill., Ois. d'Afr. i. pl. 20.
69. *Falco buson*, Wilkes, Ency. Lond. vii. p. 185 (1805).
Falco buson, Daud., Tr. ii. p. 168 (1800).
 Le Vaill., Ois. d'Afr. i. pl. . Ency. Lond. vii. pl. 7.
79. *Falco ranavorans*, Wilkes, Ency. Lond. vii. p. 186 (1805).
Falco ranivorus, Daud., Tr. ii. p. 170 (1800).
 Le Vaill., Ois. d'Afr. i. pl. 23.
91. *Falco tachiro*, Wilkes, Ency. Lond. vii. p. 187 (1805).
Falco tachiro, Daud., Tr. i. p. 90 (1800).
 Le Vaill., Ois. d'Afr. i. pl. 24.
120. *Falco albicans*, Wilkes, Ency. Lond. vii. p. 190 (1805).
Falco lanarius, var. 2, Turton, Syst. Nat. i. p. 158.
121. *Falco acolinus*, Wilkes, Ency. Lond. vii. p. 180 (1805).
Falco acoli, Daud., Tr. ii. p. 176 (1800).
 Le Vaill., Ois. d'Afr. i. pl. 31.
125. *Falco bengalensis*, Wilkes, Ency. Lond. vii. p. 190 (1805).
Falco melanoleucus, Daud., Tr. ii. p. 85 (1800) ?
 Le Vaill., Ois. d'Afr. i. pl. 32.
135. *Falco piscator*, Wilkes, Ency. Lond. vii. p. 192 (1805).
Falco frontalis, Daud., Tr. ii. p. 118 (1800).
 Le Vaill., Ois. d'Afr. i. pl. 28.
136. *Falco cantor*, Wilkes, Ency. Lond. vii. p. 192 (1805).
Falco musicus, Daud. Tr. ii. p. 116 (1800).
Falco canorus, Thunberg, Dissert. Acad. iii. p. 265 (1801).
 Le Vaill., Ois. d'Afr. i. pl. 27.
137. *Falco africanus*, Wilkes, Ency. Lond. vii. p. 193 (1805).
Falco tibialis, Daud., Tr. ii. p. 120 (1800).
 Le Vaill., Ois. d'Afr. i. pl. 29.

138. *Falco chioquera*, Wilkes, Ency. Lond. vii. p. 193 (1805).
Falco chioquera, Daud., Tr. ii. p. 121 (1800).
 Le Vaill., Ois. d'Afr. i. pl. 30.
145. *Falco caracara*, Wilkes, Ency. Lond. vii. p. 194 (1805).
Falco brasiliensis, Gm. Syst. Nat. i. p. 282?
 "Caracara" Macgregor.

Genus LANIUS.

11. *Lanius Indus*, Wilkes, Ency. Lond. xii. p. 211 (1812).
Lanius pendens, Lath., Ind. Orn. Supp. p. 19 (1801).
 Le Vaill., Ois. d'Afr. ii. pl. 66, fig. 1.
14. *LANIUS MAJOR*, Wilkes, Ency. Lond. xii. p. 212 (1812).
Lanius ioterus, Cuv., Reg. An. i. p. 352 (1829).
Tamnophilus olivaceus, Vieill., Gal. des Ois. i. p. 225 (1825).
 Le Vaill., Ois. Afr. vi. pl. 285.
15. *Lanius maximus*, Wilkes, Ency. Lond. xii. p. 212 (1812).
Lanius dubius, Lath., Ind. Orn. Supp. p. 18 (1801).
17. *Lanius javanensis*, Wilkes, Ency. Lond. xii. p. 213 (1812).
Lanius superciliosus, Lath., Ind. Orn. Supp. p. 20 (1801).
18. *Lanius Brubru*, Wilkes, Ency. Lond. xii. p. 213 (1812).
Lanius Brubru, Lath., Ind. Orn. Supp. p. 20 (1801).
 Le Vaill., Ois. Afr. ii. pl. 71.
19. *Lanius cubla*, Wilkes, Ency. Lond. xii. p. 214 (1812).
Lanius cubla, Lath., Ind. Orn. Supp. p. 20 (1801).
 Le Vaill., Ois. d'Afr. ii. pl. 72, fig. 1, 2.
20. *Lanius taciturnus*, Wilkes, Ency. Lond. xii. p. 214 (1812).
Lanius silens, Shaw, Gen. Zool. vii. p. 330 (1809).
 Le Vaill., Ois. Afr. ii. pl. 74.
21. *Lanius oliva*, Wilkes, Ency. Lond. xii. p. 214 (1812).
Lanius olivaceus, Shaw, Gen. Zool. vii. p. 330 (1809).
 Le Vaill., Ois. Afr. ii. pl. 75, 76.
67. *Lanius picus*, Wilkes, Ency. Lond. xii. p. 217 (1813).
Lanius mystaceus, Lath., Ind. Orn. Supp. p. 19 (1801).
 Le Vaill., Ois. d'Afr. ii. pl. 65.
68. *LANIUS DURUS*, Wilkes, Ency. Lond. xii. p. 218 (1813).
Sparacta cristata, Vieill., Nouv. Dict. xxxi. p. 526 (1819).
 Le Vaill., Ois. d'Afr. ii. pl. 79.
69. *Lanius Geoffroyi*, Wilkes, Ency. Lond. xii. p. 218 (1813).
Lanius plumatus, Shaw, Gen. Zool. vii. p. 292 (1809).
Prionops Geoffroyi, Vieill., Nouv. Dict. iii. p. 144 (1816).
 Le Vaill., Ois. d'Afr. ii. pl. 80, 81.

Genus BUCEROS.

10. *BUCEROS SEMILUNARIS*, Wilkes, Ency. Lond. iii. p. 479 (1808).
Buceros lunatus, Temm., Pl. Col. liv. 92 (about 1830).
 Le Vaill., Ois. Am. et Ind. pl. 13.
11. *Buceros albicornis*, Wilkes, Ency. Lond. iii. p. 479 (1808).
Buceros Pica, Scopoli, Flor. et Faun. Insub. p. 87 (1786)?
Buceros malabaricus, Gm., Syst. Nat. i. p. 359 (1788).
Buceros albirostris, Shaw, Gen. Zool. viii. p. 13 (1811).
 Le Vaill., Ois. Am. et Ind. pl. 14.

1867.]

12. *BUCCEROS VIOLACEUS*, Wilkes, Ency. Lond. iii. p. 479 (1808).
Buceros violaceus, Shaw, Gen. Zool. viii. p. 19 (1811).
 Le Vaill., Ois. Am. et Ind. pl. 19.
13. *Buceros crispatus*, Wilkes, Ency. Lond. iii. p. 479 (1808).
Buceros plicatus, Lath., Ind. Orn. i. p. 146 (1790).
Buceros undulatus, Shaw, Gen. Zool. viii. p. 26 (1811).
 Le Vaill., Ois. Am. et Ind. pl. 20, 21.
14. *Buceros Corvus*, Wilkes, Ency. Lond. iii. p. 479 (1808).
Merops corniculatus, Lath., Ind. Orn. i. p. 276 (1790).
Tropidorhynchus corniculatus (Latham).
 Le Vaill., Ois. Am. et Ind. pl. 24.
15. *BUCCEROS JAVANENSIS*, Wilkes, Ency. Lond. iii. p. 479 (1808).
Buceros javanicus, Shaw, Gen. Zool. viii. p. 28 (1811).
 Le Vaill., Ois. Am. et Ind. pl. 22.
16. *BUCCEROS GINGALA*, Wilkes, Ency. Lond. iii. p. 480 (1808).
Buceros gingalensis, Shaw, Gen. Zool. viii. p. 37 (1811).
 Le Vaill., Ois. Am. et Ind. pl. 23.
17. *BUCCEROS LONGIBANDUS*, Wilkes, Ency. Lond. iii. p. 480 (1808).
Buceros fasciatus, Shaw, Gen. Zool. viii. p. 34 (1811).
 Le Vaill., Ois. Afr. v. pl. 233.
18. *BUCCEROS CORONATUS*, Wilkes, Ency. Lond. iii. p. 480 (1808).
Buceros melanoleucus, Licht.
Buceros coronatus, Shaw, Gen. Zool. viii. p. 35 (1811).
 Le Vaill., Ois. Afr. v. pl. 234, 235.

Genus CORVUS.

2. *Corvus capistrum*, Wilkes, Ency. Lond. v. p. 237 (1802).
Corvus albicollis, Lath., Ind. Orn. i. p. 151 (1790).
Corvus cafer, Licht.
 Le Vaill., Ois. Afr. ii. pl. 50.
3. *CORVUS MAGNUS*, Wilkes, Ency. Lond. v. p. 237 (1802).
Corvus major, Vieill., Nouv. Dict. viii. p. 27 (1817).
 Le Vaill., Ois. Afr. ii. pl. 51.
39. *CORVUS SPLENDIDUS*, Wilkes, Ency. Lond. v. p. 241 (1802).
Corvus splendidus, Shaw, Gen. Zool. vii. p. 372 (1809).
 Le Vaill., Ois. Afr. ii. pl. 85.
41. *CORVUS AFER*, Wilkes, Ency. Lond. v. p. 241 (1802).
Corvus capensis, Licht.
 Le Vaill., Ois. Afr. ii. pl. 52.
44. *Corvus indicus*, Wilkes, Ency. Lond. v. p. 242 (1802).
Corvus crinitus, Daud., Traite d'Orn. ii. p. 253 (1800).
Corvus sexsetaceus, Shaw, Gen. Zool. vii. p. 380 (1809).
 Le Vaill., Ois. Afr. ii. pl. 82.
45. *Corvus Choucador*, Wilkes, Ency. Lond. v. p. 243 (1802).
Sturnus ornatus, Daud., Traite d'Orn. ii. p. 309 (1800).
 Le Vaill., Ois. Afr. ii. pl. 86.
48. *CORVUS CIRRHATUS*, Wilkes, Ency. Lond. v. p. 244 (1802).
Pica melanocephala, Wagler, Syst. Av. (1827).
 Le Vaill., Ois. Afr. ii. pl. 58.

57. *Corvus piapiao*, Wilkes, Ency. Lond. v. p. 245 (1802).
Corvus senegalenses, Linn., Syst. Nat. i. p. 158 (1766).
 Le Vaill., Ois. Afr. ii. pl. 54.
58. *Corvus ruber*, Wilkes, Ency. Lond. v. p. 245 (1802).
Corvus rufgaster, Lath., Ind. Orn. i. p. 26 Supp. (1801).
 Le Vaill., Ois. Afr. ii. pl. 55.
59. *Corvus Temia*, Wilkes, Ency. Lond. v. p. 245 (1802).
Corvus varians, Lath., Ind. Orn. Supp. p. 26 (1801).
60. *Corvus rufus*, Wilkes, Ency. Lond. v. p. 245 (1802).
Lanius rufus, Scop., Flor. et Faun. Insub. i. p. 86 (1786).
 Le Vaill., Ois. Afr. ii. pl. 59.
61. *Corvus Lanius*, Wilkes, Ency. Lond. v. p. 245 (1802).
Lanius picatus, Lath., Ind. Orn. Supp. p. 17 (1801).
 Le Vaill., Ois. Afr. ii. pl. 60.

Genus ORIOLUS.

23. *ORIOLUS AFRICANUS*, Wilkes, Ency. Lond. xvii. p. 740 (1820).
Oriolus monachus, Wagler, Syst. Av. (1827).
Oriolus Coudougnan, Temm., Pl. Col. liv. 54 (about 1826).
Oriolus larvatus, Licht., Verz. p. 20 (1823).
 Le Vaill., Ois. d'Afr. vi. pl. 261, 262.

Genus PICUS.

49. *Picus barbatus*, Wilkes, Ency. Lond. xx. p. 401 (1825).
Picus biarmicus, Cuv.
Picus namaquus, Licht., Verz. p. 17 (1823).
Picus myctaceus, Vieill., Nouv. Dict. xxvi. p. 73 (1818).
 Le Vaill., Ois. Afr. vi. pl. 251, 252.
58. *Picus erythrocephalus*, Wilkes, Ency. Lond. xx. p. 402 (1825).
Picus fulviscapus, Licht., Verz. p. 11 (1823).
Picus fuscescens, Vieill., Nouv. Dict. xxvi. p. 86 (1818).
 Le Vaill., Ois. Afr. vi. pl. 253.

Genus MEROPS.

28. *Merops monachus*, Wilkes, Ency. Lond. xv. p. 159 (1817).
 From New Holland. I cannot determine this species.
29. *Merops malimbicus*, Wilkes, Ency. Lond. xv. p. 159 (1817).
Merops bicolor, Daud., Ann. du Mus. ii. p. 440 (1803).

Genus LARUS.

1. *Larus rissa*, Wilkes, Ency. Lond. xii. p. 250 (1813).
Larus rissa, Brunnich, Orn. Bor. p. 42 (1764)?

Genus ALAUDA.

2. *ALAUDA ROSTRO-GRASSA*, Wilkes, Ency. Lond. i. p. 235 (1808).
Alauda crassirostris, Vieill., Nouv. Dict. i. p. 373 (1816).
 Le Vaill., Ois. d'Afr. iv. pl. 193.
25. *ALAUDA PERCUTIENS*, Wilkes, Ency. Lond. i. p. 236 (1808).
Alauda apiata, Vieill., Nouv. Dict. i. p. 342 (1816).
 Le Vaill., Ois. d'Afr. iv. pl. 194.

1867.]

26. *Alauda africana*, Wilkes, Ency. Lond. i. p. 236 (1808).
Alauda africana, Gm., Syst. Nat. i. p. 798 (1788).
 Le Vaill., Ois. d'Afr. iv. pl. 192.
37. *ALAUDA DORSO-RUBRA*, Wilkes, Ency. Lond. i. p. 236 (1808).
Alauda pyrrhonota, Vieill., Nouv. Dict. i. p. 361 (1816).
 Le Vaill., Ois. d'Afr. iv. pl. 197.
38. *ALAUDA PILEO-RUBRA*, Wilkes, Ency. Lond. i. p. 236 (1808).
Alauda rufipile, Vieill., Nouv. Dict. i. p. 345 (1816).
 Le Vaill., Ois. d'Afr. iv. pl. 198.

Genus AMPELIS.

1. *AMPELIS GRANDIS*, Wilkes, Ency. Lond. i. p. 483 (1796).
Coracias militaris, Lath., Ind. Orn. Supp. p. 27 (1801).
Querula rubra, Vieill.
Hamatoderus grandis, (Wilkes) !!!
 Le Vaill., Ois. Am. et Ind. pl. 25, 26.

Genus MUSCICAPA.

3. *Muscicapa nubi*, Wilkes, Ency. Lond. xvi. p. 260 (1818).
Sylvia nebulosa, Vieill., Nouv. Dict. xi. p. 204 (1817).
 Le Vaill., Ois. d'Afr. iii. pl. 149.
4. *Muscicapa loricaria*, Wilkes, Ency. Lond. xvi. p. 261 (1818).
Sylvia melanoleucus, Vieill., Nouv. Dict. xi. p. 176 (1817).
 Le Vaill., Ois. d'Afr. iii. pl. 150.
19. *Muscicapa parus*, Wilkes, Ency. Lond. xvi. p. 262 (1818).
Muscicapa subflava, Vieill., Nouv. Dict. xxi. p. 483 (1818).
 Le Vaill., Ois. d'Afr. iv. pl. 155.
39. *Muscicapa penulata*, Wilkes, Ency. Lond. xvi. p. 265 (1818).
Muscicapa cyanomelas, Vieill., Nouv. Dict. xxi. p. 473 (1818).
 Le Vaill., Ois. d'Afr. iv. pl. 151.
40. *Muscicapa superciliata*, Wilkes, Ency. Lond. xvi. p. 265 (1818).
Muscicapa perspicillata, Vieill.
 Le Vaill., Ois. d'Afr. iv. pl. 152.
106. *MUSCICAPA UNDULATA*, Wilkes, Ency. Lond. xvi. p. 269 (1818).
Muscicapa — ? Gray, Gen. i. p. 263.
 Le Vaill., Ois. d'Afr. iv. pl. 156.
 ' Not *M. undulata*, Vieill., Nouv. Dict. xxi. p. 471 (1818).
107. *Muscicapa stellata*, Wilkes, Ency. Lond. xvi. p. 270 (1818).
Muscicapa stellata, Vieill., Nouv. Dict. xxi. p. 468 (1818).
 Le Vaill., Ois. d'Afr. iv. pl. 157.
108. *Muscicapa azurufa*, Wilkes, Ency. Lond. xvi. p. 270 (1818).
Muscicapa aurea, Vieill., Nouv. Dict. xxi. p. 463 (1818).
 "Niltava azurea (Vieill.," Gray, Gen. i. p. 264.
 Le Vaill., Ois. d'Afr. iv. pl. 158.
109. *MUSCICAPA ALBICAPILLA*, Wilkes, Ency. Lond. xvi. p. 270 (1818).
 "Platysteira monacha, Swains."
 Le Vaill., Ois. d'Afr. iv. pl. 159.
110. *Muscicapa molenaria*, Wilkes, Ency. Lond. xvi. p. 270 (1818).
Muscicapa pistrinaria, Vieill., Nouv. Dict. xxi. p. 474 (1818).
Muscicapa molitor, Licht.
 Le Vaill., Ois. d'Afr. iv. pl. 160.

111. *Muscicapa pririt*, Wilkes, Ency. Lond. xvi. p. 271 (1818).
Muscicapa pririt, Vieill., Nouv. Dict. xxi. p. 486 (1818).
 Le Vaill., Ois. d'Afr. iv. pl. 161.
112. *Muscicapa drongo*, Wilkes, Ency. Lond. xvi. p. 271 (1818).
Lanius forficatus, Linn., Syst. Nat. i. p. 134 (1766).
 Le Vaill., Ois. d'Afr. iv. pl. 166.
116. *Muscicapa albiventris*, Wilkes, Ency. Lond. xvi. p. 272 (1818).
Dicrurus leucogaster, Vieill. Nouv. Dict. ix. p. 587 (1817).
Dicrurus albiventris, Steph., Gen. Zool. xiii. p. 140 (1825).
 Le Vaill., Ois. d'Afr. iv. pl. 171.
117. *Muscicapa longicauda*, Wilkes, Ency. Lond. xvi. p. 272 (1818).
Dicrurus macrocerus, Vieill., Nouv. Dict. ix. p. 588 (1817).
Dicrurus indicus, Steph., Gen. Zool. xiii. p. 139 (1825).
 Le Vaill., Ois. d'Afr. iv. pl. 174.
118. *Muscicapa malabarica*, Wilkes, Ency. Lond. xvi. p. 272 (1818).
Lanius malabaricus, Scopoli.
Dicrurus platurus, Vieill., Nouv. Dict. ix. p. 588 (1817).
 Le Vaill., Ois. d'Afr. iv. pl. 175.
119. *Muscicapa ærea*, Wilkes, Ency. Lond. xvi. p. 272 (1818).
Dicrurus æneus, Vieill., Nouv. Dict. ix. p. 586 (1817).
Dicrurus æratus, Steph., Gen. Zool. xiii. p. 138 (1825).
 Le Vaill., Ois. d'Afr. iv. pl. 176.

Genus MOTACILLA.

2. *Motacilla coryphæus*, Wilkes, Ency. Lond. xvi. p. 77 (1817).
Sylvia coryphæus, Vieill., Nouv. Dict. xi. p. 177 (1817).
 Le Vaill., Ois. d'Afr. iii. pl. 120.
16. *Motacilla citrina*, Wilkes, Ency. Lond. xvi. p. 78 (1817).
Sylvia subflava, Vieill., Nouv. Dict. xi. p. 175 (1817).
 L. Vaill., Ois. d'Afr. iii. pl. 127.
21. *Motacilla melogaster*, Wilkes, Ency. Lond. xv. p. 79 (1817).
Sylvia lunulata, Vieill., Nouv. Dict. xi. p. 210 (1817).
Sylvia gutturalis, Boie.
 Le Vaill., Ois. d'Afr. iii. pl. 123.
22. *Motacilla ruficapæ*, Wilkes, Ency. Lond. xvi. p. 80 (1817).
Sylvia fulvicapilla, Nouv. Dict. xi. p. 217 (1817).
 Le Vaill., Ois. d'Afr. iii. pl. 124.
23. *Motacilla viridis*, Wilkes, Ency. Lond. xvi. p. 80 (1817).
Sylvia olivacea, Vieill., Nouv. Dict. xi. p. 205 (1817).
 Le Vaill., Ois. d'Afr. iii. pl. 125.
24. *Motacilla grisea*, Wilkes, Ency. Lond. xvi. p. 80 (1817).
Sylvia subcærulea, Vieill., Nouv. Dict. xi. p. 188 (1817).
Parisoma rufiventer, Swains.
 Le Vaill., Ois. d'Afr. iii. pl. 126.
26. *Motacilla ciliata*, Wilkes, Ency. Lond. xvi. p. 80 (1817).
Sylvia diophrys, Vieill., Nouv. Dict. xi. p. 182 (1817).
Motacilla diophrys, Shaw, Nat. Misc. xxiii. pl. 973 (no date).
 Le Vaill., Ois. d'Afr. iii. pl. 128.
39. *Motacilla aurata*, Wilkes, Ency. Lond. xvi. p. 83 (1817).
Sylvia auraticollis, Vieill., Nouv. Dict. xi. p. 175 (1817).
 Le Vaill., Ois. d'Afr. iii. pl. 119.

1867.]

66. *Motacilla arenaria*, Wilkes, Ency. Lond. xvi. p. 85 (1817).
Motacilla capensis, Linn., Syst. Nat. i. p. 333 (1766).
 Le Vaill., Ois. d'Afr. iv. pl. 178.
67. *Motacilla variegata*, Wilkes, Ency. Lond. xvi. p. 86 (1817).
Motacilla indica, Gm., Syst. Nat. i. p. 962 (1788).
Motacilla variegata, Vieill.
 Le Vaill., Ois. d'Afr. iv. pl. 179.
68. *MOTACILLA STRIATA*, Wilkes, Ency. Lond. xvi. p. 86 (1817).
Enanthe ptymatura, Vieill., Nouv. Dict. xxi. p. 436 (1818).
 Le Vaill., Ois. d'Afr. iv. pl. 188, fig. 2.
69. *MOTACILLA RUBRA*, Wilkes, Ency. Lond. xvi. p. 86 (1817).
Enanthe rufiventris, Vieill., Nouv. Dict. xxi. p. 431 (1818).
 Le Vaill., Ois. d'Afr. iv. pl. 188, fig. 1.
70. *MOTACILLA CURSOR*, Wilkes, Ency. Lond. xvi. p. 86 (1817).
Enanthe cursorea, Vieill., Nouv. Dict. xxi. p. 431 (1818).
 Le Vaill., Ois. d'Afr. iv. pl. 190.
71. *MOTACILLA FAMILIARIS*, Wilkes, Ency. Lond. xvi. p. 86 (1817).
Enanthe sperata, Vieill., Nouv. Dict. xxi. p. 432 (1818).
Saxicola familiaris, Steph., Gen. Zool. xiii. p. 241 (1825).
 Le Vaill., Ois. d'Afr. iv. pl. 183.
80. *MOTACILLA FORMICIVORA*, Wilkes, Ency. Lond. xvi. p. 88 (1817).
Enanthe formicivora, Vieill., Nouv. Dict. xxi. p. 421 (1818).
Saxicola formicivora, Steph., Gen. Zool. xiii. p. 242 (1825).
 Le Vaill., Ois. d'Afr. iv. pl. 186, 187.
81. *MOTACILLA IMPERATOR*, Wilkes, Ency. Lond. xvi. p. 88 (1817).
Enanthe nigra, Vieill., Nouv. Dict. xxi. p. 431 (1818).
 Le Vaill., Ois. d'Afr. iv. pl. 189.
82. *MOTACILLA ALAUDA*, Wilkes, Ency. Lond. xvi. p. 88 (1817).
Alauda nigra, Stephens, Gen. Zool. xiv. p. 25 (1826).
 L. Vaill., Ois. d'Afr. iv. pl. 191.
86. *MOTACILLA TRACTRAC*, Wilkes, Ency. Lond. xvi. p. 89 (1817).
Enanthe cinerea, Vieill., Nouv. Dict. xxi. p. 437 (1818).
 Le Vaill., Ois. d'Afr. iv. pl. 184, fig. 1.
87. *MOTACILLA MONTANA*, Wilkes, Ency. Lond. xvi. p. 89 (1817).
Enanthe monticola, Vieill., Nouv. Dict. xxi. p. 434 (1818).
Saxicola Montana, Steph., Gen. Zool. xiii. p. 242 (1825).
 Le Vaill., Ois. d'Afr. iv. pl. 184, fig. 2.
93. *MOTACILLA PASTOR*, Wilkes, Ency. Lond. xvi. p. 90 (1817).
Saxicola rubicola, var. *Caffra*, Licht.
 Le Vaill., Ois. d'Afr. iv. pl. 180.
96. *Motacilla turdus*, Wilkes, Ency. Lond. xvi. p. 91 (1817).
Sylvia leucophrys, Vieill., Nouv. Dict. xi. p. 191 (1817).
Turdus pipiens, Steph., Gen. Zool. xiii. p. 202 (1826).
 Le Vaill., Ois. d'Afr. iv. pl. 118.
98. *Motacilla acutipennis*, Wilkes, Ency. Lond. xvi. p. 91 (1817).
Sylvia oxyura, Vieill., Nouv. Dict. xi. p. 161 (1817).
 Le Vaill., Ois. d'Afr. iv. pl. 133.
99. *Motacilla Amboynensis*, Wilkes, Ency. Lond. xvi. p. 91 (1817).
Sylvia rubescens, Vieill.
 Le Vaill., Ois. d'Afr. iv. pl. 136.

146. *Motacilla teheric*, Wilkes, Ency. Lond. xvi. p. 94 (1817).
Motacilla madagascariensis, Gm., Syst. Nat. i. p. 981 (but not p. 952).
Sylvia leucops, Vieill., Nouv. Dict. xi. p. 222 (1817).
 Le Vaill., Ois. d'Afr. iv. pl. 132.
188. *Motacilla garrula*, Wilkes, Ency. Lond. xvi. p. 97 (1817).
Sylvia babacula, Vieill., Nouv. Dict. xi. p. 172 (1817).
 Le Vaill., Ois. d'Afr. iii. pl. 121, fig. 1.
189. *Motacilla isabella*, Wilkes, Ency. Lond. xvi. p. 98 (1817).
Sylvia baticata, Vieill., Nouv. Dict. xi. p. 195 (1817).
 Le Vaill., Ois. d'Afr. iii. pl. 121, fig. 2.
190. *Motacilla pavo*, Wilkes, Ency. Lond. xvi. p. 98 (1817).
Sylvia brachyptera, Vieill., Nouv. Dict. xi. p. 206 (1817).
 Le Vaill., Ois. d'Afr. iii. pl. 122.
209. *MOTACILLA FIMBRIATA*, Wilkes, Ency. Lond. xvi. p. 102 (1817).
Malurus palustris, Vieill., Nouv. Dict. xx. p. 213 (1818)?
Malurus gularis, Steph., Gen. Zool. xiii. p. 224 (1825).
 Le Vaill., Ois. d'Afr. iii. pl. 130, fig. 2.
210. *Motacilla pincpinc*, Wilkes, Ency. Lond. xvi. p. 102 (1817).
Sylvia tatrix, Vieill., Nouv. Dict. xi. p. 208 (1817).
 Le Vaill., Ois. d'Afr. iii. pl. 131.
211. *MOTACILLA APUS*, Wilkes, Ency. Lond. xvi. p. 103 (1817).
Sylvia minuta, Shaw, Nat. Misc. xxiii. pl. 997 (no date).
 Le Vaill., Ois. d'Afr. iii. pl. 134.
212. *Motacilla curvata*, Wilkes, Ency. Lond. xvi. p. 103 (1817).
Motacilla rufescens, Vieill.
 Le Vaill., Ois. d'Afr. iii. pl. 135.

Genus PARUS.

33. *Parus niger*, Wilkes, Ency. Lond. xviii. p. 726 (1821).
Parus niger, Vieill., Nouv. Dict. xx. p. 325 (1818).
Parus luctuosus, Licht.
 Le Vaill., Ois. d'Afr. iii. pl. 137.
34. *Parus variegatus*, Wilkes, Ency. Lond. xviii. p. 726 (1821).
Parus cinerascens, Vieill., Nouv. Dict. xx. p. 316 (1818).
 Le Vaill., Ois. d'Afr. iii. pl. 138.
35. *Parus fuscus*, Wilkes, Ency. Lond. xviii. p. 726 (1821).
Parus fuscus, Vieill., Nouv. Dict. xx. p. 309 (1818).
 Le Vaill., Ois. d'Afr. iii. pl. 139, fig. 1.
36. *Parus albigens*, Wilkes, Ency. Lond. xviii. p. 727 (1821).
Parus cinereus, Vieill., Nouv. Dict. xx. p. 316 (1818).
Parus atriceps, Horsf., Linn. Trans. xiii. p. 160.
 Le Vaill., Ois. d'Afr. iii. pl. 139, fig. 2.
37. *Parus dubius*, Wilkes, Ency. Lond. xviii. p. 727 (1821).
Sylvia atricapilla, Vieill., Nouv. Dict.
Parus monachus, Gray, Gen. iii. p. 30, b.
 Le Vaill., Ois. d'Afr. iii. pl. 140.
38. *Parus quadricolor*, Wilkes, Ency. Lond. xviii. p. 727 (1821).
Motacilla zeylonica, Gm., Syst. Nat. i. p. 964 (1788).
Ægithina quadricolor, Vieill.
 Le Vaill., Ois. d'Afr. iii. pl. 141.

On the habits of a TIPULIDEOUS LARVA.

BY EDW. D. COPE.

There has been known in Europe for many years a small white larva, which is called the army worm, which gathers itself into large bodies forming streams of several feet in length. These bodies move forward at a slow rate, and appear to be a form of migration which the species adopts for some purpose unknown. Their superficial resemblance to a sluggish serpent usually excites repugnance in the minds of many observers. It has been found that these larvæ are those of different species of the flies of the genus *Sciara*, which belongs to the Mycetophilidæ, which was formerly regarded as a group of the great family Tipulidæ, or the crane flies.

Of this genus Osten Sacken* says: "All the larvæ of the Mycetophilidæ are gregarious, and live among decaying vegetable matters. * * *Sciara* is found among decaying leaves in vegetable mould, in cow-dung, under the bark of dead trees, etc. * * They may be distinguished from the larvæ of Mycetophila by their greater delicacy, and by the structure of the trophi; most of them seem to have no bristles or spines on the locomotive processes on the under side of the body, whereas the majority of the Mycetophila have them. They are even more gregarious than the other larvæ of this family, and have the singular propensity of sticking together in dense patches, in which situation they are frequently found, for instance, under the bark of trees. It is probably to the same propensity that the phenomenon, known in Germany under the name of army worm (*Heerwurm*), is due. This is a procession of larvæ, sometimes from twelve to fourteen feet long, and two or three inches broad, consisting of numberless specimens, sticking closely together, and forming a layer of about half an inch thickness. Such processions have been often observed in woods in Germany, Sweden and Russia, but never sufficiently investigated to explain their object. That the larvæ do not migrate in search of food, we can infer from the fact that they appear to be full-grown when they form these processions."

Prof. Berthold, of the University of Göttingen, gives a more detailed account of this larva,† as follows:

"Mr. Berthold imparted, on the 17th of December, 1853, to the Royal Society of Sciences, a zoological examination of the *Heerwurm* (army worm), which in certain years in the forests of Thuringia, Hanover, Sweden and Norway moves like a snake several feet long, four to six inches broad, and thumb-thick, which consists of myriads of small dipterous larvæ, four to five lines long. Eight years ago (Reports from the G. A. University and the Royal Society of Sciences at Goettingen, 1845, No. 5), he stated that the Tipula which was observed by the forest keeper, Mr. Rauda, at Birkenmoor, was the Thomastrauer gnat (*Sciara thomæ*), and was the means of solving a problem, which has been for hundreds of years a returning stimulus of bigotry and fear for the peasants, and for zoologists a point of earnest consideration. But when he obtained last summer from the Ellenriede, near Hanover, more new *Heerwurm* larvæ, and Mr. L. Bechstein bred some flies out of the larvæ of a *Heerwurm*, it gave him occasion to institute further examinations.

"The desire for association and migration cannot be compared with the migrations of all other insects and animals; for this is not done to procure nourishment, because the maggots are in such great quantity above each other, that but few would have a chance to reach the food. Also, the maggots do not show the desire for travelling immediately after leaving the egg, like many other insects, but the movement commences when the worm

* Who has described the larvæ, and given the bibliography of the European species, Proc. Entom. Soc. Phila. 1854. 163-170. I am indebted to this excellent entomologist for the identification of larvæ from Westtown, sent him, and for reference to the above essay.

† Nachrichten Univ. Göttingen, 1854, p. 1.

is grown, and not less than three lines long. From this it would appear to have some connection with the entrance into the pupa state.

"Their metamorphosis is known; it takes place in earth, in roots of plants, under rotten logs, or in swamps. Such moist localities are selected by the Heerwurm larvæ after they have come to a certain age, and the time of pupa change has arrived, which is known by the desire for association.

"The mucus which keeps the maggots together is a product of the salivary gland in *Sciara ingenua*, and almost all other Dipterous larvæ which have a head, and which make a fine cocoon. The formation of pupæ of the Heerwurm takes place surrounded by this mucous saliva. The Heerwurm can be regarded as a collection of larvæ, for the purpose of mutual transformation; that is, it is accomplished through mutual protection at a period favorable to development. This connection is given up before the formation of nymphs really arrives, the individuals separating, from time to time, in search of food. When now the larvæ of large divisions of Diptera, as the Pupipares, Notacanthes, etc., have the peculiarity of changing their own skin into a cover, which is the grave of the larva and the cradle for the pupa; and the larvæ of another division of the Diptera, as the Tanytomes and the Nemoceræ, before changing, strip off their cover, and are transformed free or in a cocoon, so the *Sciara thomæ* presents a process intermediate between these, as the construction of the cocoon is not performed within the skin of the larva itself, but in a cavity which is made of the skins of numbers of other larvæ."

There appears, however, to have been no record of the observation of this peculiar habit of larvæ in North America, up to within a short time. The genus is known to exist here, and Osten Sacken (l. c.) describes a species which he calls *Sciara toxoneura*. Hence the following account, which I have received from my friend William Kite, teacher at Westtown School, in Chester county, Pa., is of considerable interest. The statements are those of a careful naturalist, well acquainted with the field and field study. Before quoting it, it must be noted that another account of the same phenomenon was published in *The Friend* journal (Philada., 1864), by Charles Potts, another teacher in the same excellent institution. Some statements of this writer need correction, as further observation convinced him: *e. g.*, that they could climb.

The following are observations of Wm. Kite:—

"On the morning of Ninth month 11th, 1866, a company of worms was observed crossing the brick walk, or passage, east of Westtown School; the mass presented much the appearance of a thin grey snake. This is the third year that these worms have been seen about our grounds.

"This company extended over a length of about twenty-two inches, with a breadth of from three-quarters of an inch in the thickest part, to about one-eighth of an inch at the head, and one-tenth at the tail; five or six worms deep in thicker parts. The mode of progression of these singular creatures was by the contraction of an annulus at a time. They had distinct heads, and the motion of each was like that observed in caterpillars rather than that seen in earth-worms. The contraction commenced posteriorly, and was passed forward to the head in the successive rings.

"They advanced at the rate of four inches in five minutes, the hinder ones working their way over the top of the rest. Those who reached the ground or bricks by thus traversing their comrades' backs seemed unable to proceed, so that their progression naturally assumed the singular shape that drew our attention to them. Occasionally a few would diverge from the mass, near the front, forming another head, as it were; but they would soon return to the general company by crawling back over each other."

[This observation was also made on the procession which appeared in 1864; *i. e.*, that the hinder ones progressed over the bodies of those that preceded, the whole mass thus taking up in the rear and laying down in front. This is a much more rational explanation of their progress than has been offered; we

having been left to suppose that the lower stratum of larvæ carry the general mass.—E. D. C.]

"To arrive at an idea of their numbers, about half an inch of them were lifted out of their ranks on the point of a knife; of these 95 adhered to it, giving say 200 to the inch, or, by rough estimation, 2400 in the party.

"They were about half an inch long, semi-transparent, with black heads; their alimentary canals were clearly distinguishable by the unaided eye; the color of their contents would lead to the supposition that their food resembled that of the earth-worm. They crossed the brick path, conforming to one general direction, but varying to suit the inequalities of the walk. On reaching the grass they immediately buried themselves in the ground. This was observed to happen with a company which was seen here a year or two ago."

"*Seventh mo. 1, 1867.*

"A large company of the 'snake worms' attempted to cross a gravel walk in the yard this morning, but became entangled in the sand, which adhered to their bodies and seemed to bewilder them. School duties interfered with watching them, but I anticipated their perishing in the sand. They had managed to keep together when I saw them, after having crawled through three or four feet of sandy gravel, and may have eventually escaped.

"The most noticeable fact in regard to them was the presence among them, travelling with and over them, of a full-grown maggot of a fly! It was very lively, diving into the mass and emerging again, as though quite at home. How did it get there? and why did it associate with them? Was it hatched among them?

"Their course was about N. W."

"*Seventh mo. 5, 1867.*

"A small company of *those worms* again on the gravel walk, within a few feet of the same place as on the 1st inst. As they were going in an opposite direction from those on the 1st, they may be the same company. There were several many-footed worms, about an inch long, accompanying them; these were engaged in pulling worms out of the procession and devouring them. On both occasions the companies were noticed early in the morning, as though they commenced moving in the night.

"Their course was about S."

"*Seventh mo. 8, 1867.*

"A much larger company of these worms were on the brick walk. They had nearly crossed the walk before 7 A. M., showing they commenced moving early in the morning. They appeared unusually lively. Upon careful examination, we found the train extending back into the grass eighteen inches to a cluster of them which appeared to be issuing out of the ground. They moved on the surface of the ground, winding among the grass to avoid the stems. This disproves our former supposition that they emerged to avoid some obstruction. We were necessarily called off, and on our return the traces of them were lost. Some ants and one small worm seemed engaged in eating them; the worms apparently appreciated their danger, shrinking from the touch of these animals. This procession measured six feet six inches. Occasionally one would be left on the ground after the train had passed, but most of them kept with the general mass.

"Their course was about N. W."

"*Seventh mo. 9, 1867.*

"Two more small companies of these worms appeared, apparently the remains of the large party of yesterday. Each company was short of a foot in length, and were accompanied by quite a number of the worms noticed before with them. I caught and preserved a number of these; they resemble the worms found in cured meat, or similar ones found in many garden vegetables. Their connection with the emigrant parties seems to be that of enemies, preying on them.

"Course N. W."

[Dec.

"Seventh mo. 15, 1867.

"7 o'clock.—A cool morning. Found a small company of these worms on the brick walk near the office. Some passer had trod on them, and they were thrown into confusion; added to this, a colony of ants had intercepted their course, and carried them off in numbers. They were massed in a crowd, and their efforts to move on were defeated by the ants seizing their leaders at each attempt to move.

"8.30.—The perseverance of the ants in carrying away the worms seems to demoralize them entirely, and finally two bricks being placed to protect them from passers' feet, the greater portion of them crept under one of them and huddled together in a confused mass, where they became an easy prey to their indefatigable little enemies, who were to be seen through the morning marching off with their captives, though much larger than themselves.

"10 o'clock.—All gone.

"Course, so far as they were permitted to go, N. W."

The "many-footed worms" which devoured the *Sciara* larvæ were larvæ of some species of the Coleopterous family Staphylinidæ. Several specimens were sent with the *Sciara*.

I am also informed that a procession of this species has been seen on Quaker Hill, in the borough of West Chester. Dr. Benj. H. Coates informs me that he has seen their trains in Hunterdon county, N. J., and T. A. Conrad saw them some years ago in his garden in Burlington, in the same State.

On inquiry of my friend Jacob Stauffer, of Lancaster, whose MS. notes on the species of insects of his region, and their habits, are numerous, I received the following additions to our stock of knowledge of the habits of the larva of the *Sciara*:

"On the 10th of August, 1865, Mr. Rathvon and myself were informed by Dr. Geo. McCalla that we would be interested by examining an army of small shining worms on the march in the yard of Col. D. Patterson, in W. King street, Lancaster.

"On our arrival we found the order of march thrown into great confusion by boiling water, which the women had poured along the line. I collected quite a number of stragglers from the main army thus routed, as did also friend Rathvon. These I subjected to a close examination under a strong magnifying power. My notes read thus: 'A portion, about two feet in length, looked like a shining cord, not uniform in outline, yet compact. These larvæ were about half an inch long mostly, perhaps three-eighths of an inch, and seven-sixteenths and one-thirty-second parts of an inch in diameter. Their heads of a glossy jet-black color, as also the anterior edge of the first joint of segment; rest of the first, and the second and third joints of a translucent milky-white, dorsally watery, with an interior wavy, brownish, intestinal canal, visible through the transparent skin; there is also a lateral tinge or bronze-yellow; otherwise of a shining, water-and-milk-like color. I could observe no pectoral or anal legs; they moved by contracting and extending the segments of their body (twelve in number) alternately, like that of a dipterous larva of Tipulidæ. In motion the convolutions of the intestinal canal were very apparent. They seemed to interlace with each other, but, having been disturbed, I cannot venture to say whether after any precise order, or by simple conglomeration as chance may demand. When first seen they were moving in a broad columnar mass, rope-like, seeming like a shining guard-chain cord, of considerable thickness and quite ornamental, like jet beads mixed in with pearly-white beads in motion.'

"The following is a copy from a letter by Prof. W. S. Roedel, Wytheville, Virginia, Aug. 4. 1865, in his own words:

"On Saturday, July 15, 1865, at North Lebanon, Pa., I observed in a path at the foot of a hill, what I at first glance supposed to be the cast-off skin of a serpent, which the object resembled in color and general appearance, but what, 1867.]

upon close inspection, I found to be a multitude of caterpillars, a half-inch in length and one-thirty-second part of an inch in diameter; head of a dull red or brownish color, bodies smooth and somewhat glistening.

"These worms moved upon one another, piled upon and irregularly interwoven among each other like a flattened rope. The head of the column was much broader than the rest, being two inches wide, from which dimension the column gradually tapered (to a point, I suppose, for I did not see the end of it). The length of the column was four feet to a fence, beyond which I did not examine it.

"A portion of the column lay in the grass, through which it moved without interruption, as if it had been a solid mass. The rate of motion was extremely slow, not exceeding one-eighth of an inch in a minute. The color of the mass was as much like a rope of tow which has been exposed to the weather as anything I can think of; it might be called a rusty gray. The column was not cylindrical,—that is, a cross section would be elliptical."

"The Springfield (Mass.) Republican of August, 1865, gives an account of a 'reptile' found at Lee. It was nearly four feet in length, about the size of a man's finger, and shaped like a whip-lash; and on close examination the whole body was found to be composed of small worms about half an inch in length, with large black heads, and semi-transparent body. On separating them into fragments, they would immediately re-form into a snake shape, and crawl slowly off. One or two similar snakes have recently been seen in that vicinity." This was copied into the Lancaster Evening Express of Saturday, Aug. 12, 1865."

The Mechanical Theory of SOLAR HEAT.

BY JACOB ENNIS.

During the last quarter of a century scientific men have endeavored by new methods to account for the heat of the sun, and they now generally believe, or incline to believe, in its mechanical origin. Some adopt the meteoric theory. They suppose that meteorites are falling with great velocity in the sun, and that these stones strike the enormous solar fire by their fall. Others adopt the nebular theory. They suppose that the sun and all his attending planets and satellites have condensed from a very rare nebulous condition, and that the mere condensation, or falling together of their materials by the force of gravity, has produced all the solar heat. Others again combine both these theories. They believe that originally the sun and the earth were heated to a fused condition by mere condensation, and that since then the meteorites have continued the heat of the sun. The only source of heat by all these theories is gravity, because gravity causes the fall of matter, whether in a nebulous or a meteoric condition, and this falling, this mechanical force, is converted into heat. My object in this paper is to show that none of these views can stand the test of numbers and of well established facts. The high place which the mechanical theory of solar heat now holds in the scientific world, is my apology for this appearance.

Some of the important statements of the highly distinguished gentlemen who have formed the mechanical theory are these:

I. Dr. Julius Robert Mayer, of Heilbronn, says that a mass of burning coal equal to that of the sun would supply his present emission of heat only 4600 years; and that a meteorite falling into the sun would supply at least 4600 times more heat than the same weight of burning coal. Hence a mass of meteorites equal to the sun would supply his heat $4600 \times 4600 = 21,160,000$ years. This would be the least amount of heat when, as is most natural, that mass of meteorites should approach the sun spirally. If they should fall in a direct line, as would be most unlikely, the heat would be double this amount. This greatest possible amount of heat, being out of probability, is

[Dec.

not taken into the account. Let it be clearly understood that the above 21,160,000 years of heat are to be derived not from the materials of the sun falling together, but from a mass of meteorites equal to the sun falling into the sun; the gravity of the sun not being thereby increased. The substance of the meteorites are supposed, by Mayer's theory, to be radiated away into space just as fast as they fall. The two ideas are vastly different. But how long would be the duration of solar heat by the mere falling together of the solar mass from infinite space? We may compute an answer from other statements of these gentlemen, as follows:

II. Speaking of the enlargement of the sun by the continued fall of meteorites, Dr. Mayer says: "the increase of volume could scarcely be appreciated by man; for if the specific gravity of these cosmical masses be assumed to be the same as that of the sun, the enlargement of his apparent diameter to the extent of one second, the smallest appreciable magnitude, would require from 33,000 to 66,000 years." These two periods are derived, the one from the spiral and the other from the direct fall. We will take the most probable medium,—say 41,360 years. A second of measure at the distance of the sun is about 470 miles. These turned into feet would be $470 \times 5280 = 2,481,600$ feet. An increase in the sun's diameter this number of feet in 41,360 years would be 60 feet in one year. Prof. Wm. Thomson, of Edinburgh, says that the fall of meteorites necessary to keep alive the present supply of solar heat would amount to an increase in the sun's diameter of one mile in 88 years. This again would be 60 feet in one year. At this rate of increase we may learn in how long a time the sun would grow from a mere point to his present size; or, in other words, how long would be the duration of solar heat from the falling together of the present mass of the sun. Thus, when the sun had only one-half its present diameter, it had only one-eighth of its present volume and mass, and its force of gravity was only one-eighth of what it now is. Therefore eight times its present fall of materials would be necessary. Its surface was only one-fourth as large, and hence, on this latter account alone, the stratum of meteorites would be thickened four-fold. Hence, when the sun had one-half of his present diameter, the annual thickness of the stratum of meteorites would be $30 \times 8 \times 4 = 960$ feet. Here we have an arithmetical progression. For the first year or term the number is 30; for the last year or term the number is 960. The sum of all the terms is $220,500 \text{ miles} \times 5280 \text{ feet per mile} = 1,164,240,000 \text{ feet}$. Now what is the number of terms or years necessary for this number of feet, the sum of all the terms? Let y be the number of terms. Then

$$\frac{30 + 960}{2} \times y = 1,164,240,000$$

$$y = 2,352,000 \text{ years.}$$

Hence, from this mode of calculating, the sun, from one-eighth of his present size, would grow to be what it now is in 2,352,000 years. This, however, is but an approximation. We have taken the force of gravity to be no stronger in proportion to its mass than on the present surface; whereas nearer its centre it would be stronger; and there would be 220,500 more miles to fall. But our approximation is near enough for our present purpose, and we come to the conclusion that the entire falling force of all the materials of the sun, when gravitating together, would supply the present rate of heat not more than 3,000,000 years.

III. In remarkable contrast to the last statement, we have the following from Prof. Herman L. F. Helmholtz, of Heidelberg: "Let us make this addition to our assumption: that, at the commencement, the density of the nebulous matter was a vanishing quantity, as compared with the present density of the sun and planets; we can then calculate how much work has been performed by the condensation; we can further calculate how much of this work still exists in the form of mechanical force, as attraction of the planets towards the sun, and as *vis viva* of their motion, and find by this how much of 1867.]

the force has been converted into heat. The result of this calculation is that only about the 454th part of the original mechanical force remains as such, and that the remainder, converted into heat, would be sufficient to raise a mass of water equal to the sun and planets taken together, not less than 28,000,000 degrees of the centigrade scale. If the mass of our entire system were pure coal, by the combustion of the whole of it only the 3500th part of the above quantity would be generated." There is much ambiguity here in the words "remains" and "remainder." Prof. John Tyndall, of the Royal Institution, London, in his excellent work on "Heat as a Mode of Motion," takes both words to refer to the same thing. But really "remains" refers to the force still in store, as the attraction of the planets to the sun, and the *vis viva* of their motion. The "remainder" refers to the force of gravity already converted into heat during all past time. This past time has been so long that the burning of the solar system as pure coal would have furnished the heat for only the 3500th part of the time. But Mayer says that the burning of so much coal would last only 4600 years. Therefore $3500 \times 4600 = 16,100,000$ years for all past time, since the sun has been giving light and heat as he now does. Thomson says that a mass of carbon entering the sun, and burning with oxygen, would give out heat only equal to the 3000th part of its heat produced by the fall. Mayer says a meteorite, by its fall into the sun, develops from 4600 to 9200 times as much heat as would be generated by the burning of an equal mass of coal. If we take Mayer's lowest number, the most probable, the period would be $4600 \times 4600 = 21,160,000$ years. Thomson has given tables to show that the store of heat in the solar system, as the attraction of the bodies and as the *vis viva* of their motions, would last 45,723 years. Helmholtz says this is only the 454th part of the original store. Hence $45,723 \times 454 = 20,758,242$ years; a result remarkably near the above 21,160,000, and very far from the 3,000,000 years which I have attained from the data of Mayer and Thomson. The question now occurs, by what process of calculation has Helmholtz made the original falling force 454 times greater than what still remains, and that it would supply our heat for 21,160,000 years, instead of the approximation of 3,000,000 by my process above? I suppose he has done so by calculating the heat derived from the falling of a mass equal to the sun into another mass of the same amount; the gravity of the sun being not thereby increased, according to Mayer's theory! Mathematics have never been my leading study, and I have not the time for calculating the amount of heat to be developed in years by the falling of the materials of the sun from infinite space down to as near the centre of gravity as we now behold them. It would be an addition to science were some professed mathematician to publish this result by a method different from the one above by which I obtained the 3,000,000 years.

IV. The following statement of Helmholtz has been often quoted, and is still going around: "With regard to the store of chemical force in the sun, we can form no conjecture, and the store of heat existing therein can only be determined by very uncertain estimations. If, however, we adopt the very probable view that the remarkably small density of so large a body is caused by its high temperature, and that its density may become greater in time, it may be calculated that, if the diameter of the sun were diminished only the ten-thousandth part of its present length, by this act a sufficient quantity of heat would be generated to cover the total emission of 2100 years." Another form of the same statement has since been made, as follows: "If the sun be still contracting, the falling force thus brought into action would be sufficient to supply all the energy expended by the sun's radiations, if the contraction of the sun's diameter should only amount to one part in twenty millions in a year." This latter statement is derived from Helmholtz in this way: According to him, the surface of the sun must fall in all around towards the centre 110 feet every year to produce our present annual supply of heat. But 110 feet is the 21,000,000th part of the sun's radius. The entire statement seems

[Dec.

to me in very strange contrast with all the others we have just reviewed. It amounts to nearly this: If the sun should contract in volume from what it now is to half its present diameter, this falling of its surface less than a quarter of a million of miles would afford solar heat for ten millions of years. Whereas the falling of its surface, by contraction, through many thousand millions of miles, has produced heat enough for only double that period, according to Helmholtz, and for only 3,000,000 years, according to my calculation already made in this paper. To me this statement about a supply of heat for 10,000,000 years to come seems more erroneous by far than the one about heat for 20,000,000 years of the past by mere falling force. His processes for arriving at these conclusions are not given; until they are given, the mere assertions seem plainly contradicted by reliable data already reviewed.

After these statements of the mechanical theory of solar heat, we will now examine the objections to its various phases.

V. That phase of the mechanical theory which assumes that the heat of the sun proceeds from his own condensation by the force of gravity, is objectionable on account of the short supply of heat. It would be only twenty millions of years, according to the longest statement, which I think I have shown to be erroneous. That twenty millions of years are plainly due to the falling together of two masses, both equal to our sun. Three millions are nearer the truth, which is obtained by the rate of growth in the sun, according to the meteoric theory. But even twenty millions of years are nothing when compared with the vast lapse of time, or rather of eternity, that is past. The experiments of Bischof on basalt show that for our globe to cool down from 2000 degrees to 200 degrees centigrade, would require 350,000,000 years. This result has been quoted and approved extensively by the highest authorities, among others by Helmholtz, and by Tyndall in his work on heat. Undoubtedly our globe was heated to a point as high as 2000° C. In "The Origin of the Stars" I have shown that the simple chemical elements composing our globe were created separately and uncombined, that they could not have combined slowly, but that they must have combined freely and rapidly, and in so doing our globe must have been all aflame, like the sun. Then for our earth to cool from 300° C. down so far as to be habitable for plants and animals, would require one hundred or two hundred millions of years more. Then come the long periods for the deposition of the fossiliferous strata; and these, the longer they are studied, seem to require longer and longer periods of time. This is my experience, after studying them forty years. Darwin computes, from data which seem sound, that 300,000,000 years have elapsed since the period of the weald, the latter part of the secondary. This latter part of the secondary, along with the tertiary, forms but a very small part of the stratified rocks. But we have been speaking only of the solid and the fused conditions of our planet. My many years of study on the nebulous condition of the great globes of space, impress me with nebulous periods equally as long and as incomprehensible as the fused and the solidified periods. In this way, while studying the monuments of the past set up by the Creator of the Universe for our guidance, our reason carries us back not only hundreds of millions, but thousands of millions of years, and, in endeavoring to conceive of these long periods, the mind is just as completely overburdened and bewildered as when we try to conceive of the immensity of space revealed by astronomy. By the side of all this how insignificant appears the three millions of years taken by the sun to give out his light by the mere falling force of his own materials. Even the twenty millions of years advocated by some appears no better. Therefore this phase of the mechanical theory of solar heat is untenable. Neither can it account for the former igneous fluidity of our globe. During the slow nebulous condensation the heat from that source must have slowly radiated away, and we must look to the chemical combination of its elements for its former fused condition.

VI. Mayer, the first originator of the meteoric theory of solar heat, calcu-
1867

lated that the yearly accumulation of meteoric matter on the sun would so greatly increase the centripetal force of the solar system as to shorten our years from $\frac{1}{2}$ to $\frac{1}{3}$ of a second. This shortening of our years does not agree with our present astronomical observations. Moreover Laplace proved, from the observations of Hipparchus, that during the last 20 centuries our days have not been shortened by the one-three-hundredth part of a second. To escape this difficulty Mayer proposed the extraordinary idea that, by the undulatory theory, as well as by the old corpuscular theory of Newton, "the sun, like the ocean, is all the while receiving and losing equal quantities of matter." All the matter of the meteorites must be repelled back into space just as fast as they fall. But this is in direct contradiction to the theory of the conservation of force. The force imparted to the sun by the fall of meteorites might indeed repel them all back again precisely where they came from, providing there existed a condition of perfect elasticity. But this elastic rebound would completely exhaust all the force received by the fall, and no force could be left to be converted into light and heat. To make the sun give out light and heat with a force equivalent to the fall, and also to send back the meteors with a force equivalent to the fall, would be making the sun perform exactly double duty. Still another objection arises, equally as strong: It would be like saying that when a body burns, the products of combustion are radiated away in the forms of light and heat. But experiments in abundance have proved that chemical combinations lose none of their materials by light and heat. It would be hard to find a more clear or a more acute mind than that of Mayer, and yet, to save his grand and magnificent meteoric theory, he was led, no doubt reluctantly, to this idea of immense quantities of matter radiated away by the undulatory theory. We may say immense quantities, because the radiation of the sun would amount to his entire mass in 3,000,000 years; and a mass equal to the great globe on which we dwell in the lifetime of an aged man.

VII. Professor Wm. Thomson, of Edinburgh, endeavored to save the meteoric theory by a very different method. He supposed that meteorites are revolving around the sun within the earth's orbit, and that they appear to our vision in the zodiacal light. Being resisted by the solar atmosphere, they fall in the sun, and being already within our orbit their fall does not shorten our year. There are two objections to this phase of the meteoric theory. The first is that it does not allow time enough for geological facts. For the stability of the solar system, the meteorites must revolve around the sun in the same direction as the planets. They must come down spirally and hasten the rotation of the sun. Assuming that before their fall the sun did not rotate on its axis, then, to keep up the present emission of heat, the meteorites, according to Thomson, would give the present velocity to the sun in 32,000 years. Therefore sunlight has existed only during the past 32,000 years. Therefore the fossil plants away down in the lowest strata of our earth lived and flourished and were nourished by the light of the sun only 32,000 years ago! Sir Charles Lyell, in his *Antiquity of Man*, calculated that the bones and implements of men, found in what may truly be called superficial strata, are at least 100,000 years old, and in this I believe he is now supported by the assent of all geologists.

The second objection to Prof. Thomson's phase of the meteoric theory, is that it opposes not only the geological, but also the nebular theory. The nebular theory must no longer be regarded as a vague hypothesis, but as a scientific verity. In *The Origin of the Stars*, and in a paper in this volume of these Proceedings, I have proved mathematically that the velocities of all the members of the solar system, more than a hundred in all, are just such as they must have by the force of gravity acting according to the nebular theory; and that not only their various velocities, but the directions of their complicated motions, and the positions of their orbits, are just what the force of gravity would necessarily produce. I have given evidences equally as

[Dec.

strong that gravity imparted all their motions to all the stars in their orbits, as we have ever had that gravity now holds them in those very orbits. For these and many other reasons the nebular theory must be regarded as established. The supposition that the rotation of the sun has been caused by meteorites is directly opposed to the very foundation of the nebular theory, which teaches that the original rapid rotation of the sun by centrifugal force produced all the planets, planetoids, and also these very meteorites of the zodiacal light, if such there be. These meteorites must have had the same origin as the other members of the solar system, because they move in the same plane and in the same direction. Therefore these meteorites, if such there be, have derived their velocities from the sun, and not the sun from the meteorites. The wonder is, not that the sun now rotates so rapidly, but so slowly. When his surface extended to the orbit of Mercury his velocity of rotation was 110,000 miles per hour. Now it is only 4560 miles per hour. How has it been retarded? I have shown that in many, probably in most, cases the rotation of a nebula can be only on the surface, and that ultimately it must be retarded by friction on the unrotating interior. Between the orbit of Mercury and the present surface of the sun, the velocity of rotation must have been vastly increased in order to abandon any planetary or meteoric matter. But in reality the velocity was decreased, and therefore none could have been abandoned. Even before the abandonment of Mercury, there was a slackening of the rate of increase in solar rotation. It is on this account that the interplanetary space between Venus and Mercury is greater than that between the Earth and Venus, contrary to the law of all the other planets. For all the interplanetary spaces become less and less in approaching toward the sun, in consequence of the greater rate of nebular rotation. Therefore, in consequence of the slackened rate of rotation, we could look, according to the nebular theory, for no large mass of meteoric matter abandoned by the sun inside the orbit of the earth. But, for argument sake, let us suppose that a large amount of meteoric matter was thus abandoned, and let it be equal to the mass of Venus. This truly is a very liberal allowance. Then how long would its fall in the sun keep alive his present rate of heat? According to Thomson, the fall of Venus in the sun would prolong his heat just 83 years and 227 days. This is a wonderful contrast with the inconceivable millions of years demanded by the other facts of science.

Mayer's phase of the meteoric theory is also opposed to the nebular theory. I suppose he must have seen that the present interior heat of the earth and its former entire igneous fusion could not be accounted for by the fall of meteorites, because they must have ceased gradually, and we would now find a thick crust of meteoric matter on the surface of our planet. He therefore supposes that the heat was caused by a collision with another large body. This collision must have produced not only the heat but also the rotation of the earth. The same must have occurred with the moon, because the lunar mountains and volcanoes exhibit unmistakeable evidences of former fusion and interior heat. The same also must have happened to the other planets and satellites, for they all rotate. Therefore, according to this view, each of the planets and satellites must have found a fellow to strike them, most wonderful to tell, precisely in the same way, and impart to them all their rotations in the same direction! But the solar system is constructed on different principles. There can be no collision of large planetary bodies; much less a very peculiar system of collisions to make them all rotate and move in their orbits exactly in the same way!

Thus we see insurmountable objections against all the three phases of the mechanical theory of solar heat. The old theory of luminous, calorific, cloud-like envelopes floating in the atmosphere of the sun, is very generally given up; but even this does not attempt to point out the cause of the heat in the supposed envelopes. There remains only the chemical theory, which has but the one objection, that there is not a sufficient amount of fuel in the sun.

This objection I have shown, in *The Origin of the Stars*, to be founded on at least three groundless assumptions; founded, in fact, on our ignorance. It pretends to say that the materials of the sun, pound for pound, can give out no more heat than the materials of the earth. It pretends to say that the physical forces, all alive in the sun, can produce no more heat in connection with chemical combination than in our laboratories. It pretends to say that in the condensation of the sun no new chemical elements can be produced to serve as new fuel. It pretends all this in profound ignorance of what it ought to know for such assertions. On the contrary, I have shown various probabilities that the vastly different materials of the sun give out unspeakably more heat. I have shown various probabilities that all the physical forces alive together in the sun can produce more heat in connection with chemical combination than in our little laboratories. I have shown, what seems to me conclusive proofs, that new chemical elements are now forming in the sun to serve as new fuel. These probabilities I do not call my demonstration. But beyond all this I have given, as my special demonstration, large numbers of facts and arguments, derived from the earth, the sun and the fixed stars, to prove that solar heat springs from chemical action. Until some one in the scientific world attempts to answer my facts and arguments, I need say nothing further.

There are many other objections to the mechanical theory, but I think quite enough have here been given to put the discussion at rest forever.

Descriptions of Five New Species of Central American BIRDS.

BY GEO. N. LAWRENCE.

1. *GLAUCIS AENEUS*.

Front and top of the head dull brown, upper plumage besides of a shining coppery bronze, the upper tail coverts are rather more bronzy, with dull grayish margins; the two central tail feathers are of a dull pale bronzy green, the other tail feathers are chestnut at base, with a broad subterminal band of black, all of them end in white; ear coverts black; a pale rufous stripe runs from the bill under the eye, and there is a postocular mark or streak of the same color; a dusky line extends from the under mandible down each side of the neck; the entire under plumage and under tail coverts are of a clear rufous; upper mandible black, the under is dull yellow for two-thirds its length, with the end black; feet pale yellow.

Length (skin) $4\frac{1}{2}$ in.; wing 2 1-16th; tail $1\frac{1}{2}$; bill $1\frac{1}{4}$.

Habitat.—Costa Rica. Collected by A. R. Endrés. Type in Museum of Smithsonian Institution.

Remarks.—This species differs from *G. hirsuta* and its allies in the bronzy coloring of its upper plumage, and also in being smaller; in the well marked band on the tail feathers it is much like *G. affinis*, but the color of the band is of a deeper black, not bluish black; the tail feathers are narrower than in *affinis*, and the under tail coverts more rufous.

Several specimens examined vary only in some having their upper plumage more of a golden bronze, others being more coppery; none have the under mandible of a clear yellow, some scarcely showing that color, the bill appearing to be entirely black.

2. *EUPHERUSA NIGRIVENTRIS*.

Fore part of the head as far as upon a line with the back part of the eyes, and the entire under surface deep velvety black; occiput dull ashy brown, upper plumage grass green tinged with golden; upper tail coverts of a dull coppery bronze; the four central tail feathers blackish purple, the three lateral on each side pure white; primaries brownish purple; the wing coverts green like the back; the secondaries are chestnut at the base with their ends

[Dec.

purple; sides under the wings dull green; the vent and under tail coverts white; bill black; feet yellowish.

Length (skin) $3\frac{1}{2}$ in.; wing 2; tail $1\frac{1}{2}$; bill $\frac{3}{4}$.

Habitat.—Costa Rica. Collected by A. R. Endrés.

Type in Museum of Smithsonian Institution.

Remarks.—The combination of colors in this bird is of an unusual character, and I know of none which it at all resembles. I consider it strictly congeneric with the species heretofore placed by me in *Eupherusa*, viz., my *E. cupreiceps* and *Thaumantias chionurus* of Mr. Gould. In the present species the character of the secondaries being chestnut, I think strengthen its claims to an alliance with *E. eximia*.

3. THAUMANTIAS LUCIE.

Upper plumage of a dull bronzy dark green, the crown duller; the upper tail coverts of a lighter bronzy green, somewhat golden; the tail feathers are dull bronzy green, all except the two central ones are broadly marked near their ends with dark purplish bronze, the tips being ashy gray; the throat and breast are glittering bluish green, middle of the abdomen white; the under tail coverts are light olive margined with white; wings brownish purple; upper mandible black, the under yellow with the end blackish; feet black.

Length (skin) $3\frac{1}{2}$ in.; wing $2\frac{1}{2}$; tail $1\frac{1}{2}$; bill 13 16ths.

Habitat.—Honduras.

Remarks.—In size and colors of the body this species is much like *T. Linnei*, but the tail is quite different, and closely resembles, in the coloring of its under surface, that of *T. chionopectus*.

This was the only specimen in the collection from which I obtained it, but there were many specimens of *T. candidus*.

This species is dedicated to Miss Lucy Brewer, daughter of my friend Dr. Thomas M. Brewer, of Boston.

4. DROMOCOCYX RUFIGULARIS.

Head above and entire upper plumage rich dark brown of a purplish lustre; the tips of the feathers on the head, back and wing coverts are sparingly marked with minute spots of pale rufous, some of the larger coverts are more rufous at their ends, the color extending for some distance along the shafts; the upper tail coverts, which are much lengthened, are of a duller brown than the back, they have a greenish gloss, and are margined with dull gray; the tail feathers are much the same in color as the back, and are narrowly edged on both webs with very pale rufous; the tail underneath is of a clear grayish ash, with the shafts of the feathers white, and the edges of the feathers narrowly marked with whitish; quill feathers brown, with their shafts white underneath, and the inner webs marked with white at the base; a postocular stripe of light rufous extends to the hind neck; ear coverts dark brown; sides of the neck, throat and upper part of the breast rufous, paler on the throat and deeper in color on the breast, on the latter some of the feathers have their edges narrowly marked with black; the color of the breast connects with the rufous stripe running back from the eye; the remaining under parts with the under tail coverts, white; the greater part of the upper mandible is black, the edges together with the under mandible being yellow; tarsi and toes brown, soles of the feet yellow.

Length (skin) $10\frac{1}{2}$ in.; wing 6; tail $6\frac{1}{2}$; tarsi $1\frac{1}{2}$; bill $\frac{3}{4}$.

Habitat.—Guatemala. Obtained from Dr. C. H. Van Patten, who had no knowledge concerning it, except that it came from a high mountain region.

Remarks.—This species is much smaller and of a more delicate form than *D. phasianellus*, Max. (*D. mexicanus*, Bp.), and is quite different in coloration, that having the crown and crest dark cinnamon, the wing coverts conspicuously edged with whitish, the postocular stripe nearly white and the throat and upper breast spotted and streaked with black; the feet in the new species are much weaker.

1867.]

5. *ARAMIDES ALBIVENTRIS*.

Occiput and part of hind neck brownish cinnamon; chin and throat whitish; fore part of the head and crown, with the neck behind and in front of a clear bluish gray; back and wings greenish olive; rump, tail, flanks, abdomen and under tail coverts black; thighs smoky black; quills bright reddish cinnamon; under wing coverts dull pale cinnamon, with blackish bars; breast pale cinnamon, this color extending round partly on the back; the elongated feathers of the breast, which extend down the sides of the abdomen are white, and form a conspicuous broad mark in shape of the letter U inverted, which contrasts strikingly with the reddish and black colors above and below it; the bill is orange as far as the nostrils and pale greenish yellow at the end; the legs appear to have been light vermillion.

Length about 21 in.; wing $7\frac{1}{2}$; tail $2\frac{1}{2}$; bare part of tibia 1; tarsi 3; bill $2\frac{1}{2}$.

Habitat.—British Honduras.

Remarks.—I have had the above described specimen for some time, and considered it to be a new species, but delayed publishing it. I have recently obtained another precisely like it, that came from Guatemala.

It differs from *A. Cayennensis*, Gm., in the breast being of a pale instead of a deep cinnamon red, and in having the white mark on the abdomen.

Additional Note on the "CHINCH-BUG."

BY HENRY SHIMER, M. D.

The "Chinch-bug" has entirely disappeared from this region, so far as I have been able to observe. I have made diligent search since spring, with the object of obtaining a few living specimens, but up to this time have not succeeded in finding a single specimen. I am convinced that the efficient cause of their entire destruction exists in the continuation of the epidemic among them. Their overthrow is a cause of great rejoicing among the farmers. And once more, as of yore, they have realized a bountiful wheat harvest. I have but one thing to regret in their annihilation; I neglected to obtain a good supply of specimens, while they might have been secured by the wagon load.

Mt. Carroll, Ill., Sept. 16, 1867.

Prof. Cope gave an account of the extinct reptiles which approached the birds. He said that this approximation appeared to be at two points. The first by the Pterosauria, to which the modified bird Archaeopteryx presented points of affinity. The second, and one not less striking, is by the Dinosauria of the orders Goniopoda and Symphypoda. He showed the essential differences between the ordinary Dinosauria and the birds to consist in the distinct tarsal bones in two series, the anteriorly directed pubes, and the presence of teeth, of the first class. In the genus *Laelaps* Cope, type of the Goniopoda, the proximal series of tarsal bones was principally represented by one large astragaloid piece which had a very extensive motion on those of the second series. This was immovably bound to, and embraced, the tibia, and was perhaps continuous with the fibula, much resembling the structure of the foot of the chick of the ninth day, as given by Gegenbaur. The zygomatic arch was of a very light description. He was convinced that the most bird-like of the tracks of the Connecticut sandstone were made by a nearly allied genus, the *Bathynathus* Leidy. These creatures, no doubt, assumed a more or less erect position, and the weight of the viscera, etc., was supported by the slender and dense pubic bones, which were to some extent analogous to the marsupial bones of Implacental Mammalia, though probably not homologous with them.

He said he was satisfied that the so-called clavicles of *Iguanodon* and other Dinosauria were pubes, having a position similar to those of the Crocodilia.

[Dec.

Also that a species of *Lælaps* had been observed in France, by Cuvier, which was different from the *L. aquilunguis*, and which he proposed should be called *Lælaps gallicus*.

Compsognathus Wagner, type of the *Symphypoda*, expressed the characters of the latter in the entire union of the tibia and fibula with the first series of tarsal bones, a feature formerly supposed to belong to the class *Aves* alone, until pointed out by Gegenbaur. This genus also offered an approach to the birds in the transverse direction of the pubes, (unless this be due to distortion in the specimen figured by Wagner,) their position being intermediate between the position in most reptiles and in birds. Other bird-like features were the great number and elongation of the vertebræ of the neck, and the very light construction of the arches and other bones of the head.

He thought the penguin, with its separated metatarsals, formed an approach on the side of the birds, but whether the closest approximation to the *Symphypoda* should be looked for here or among the long-tailed *Ratitæ* (ostrich, etc.,) he was unable to indicate.

The following reports of the Curators, Librarian and Recording Secretary were read :

REPORT OF THE CURATORS.

The Curators, in the presentation of their usual Annual Report, take pleasure in announcing to the members of the Academy that its Museum is throughout in a fair state of preservation, and during the last year has continued to increase, through the interest and liberality of the lovers of natural history. Through the same qualities we have been provided with a large amount of means, upwards of \$100,000, towards the purchase of ground and the erection of a more capacious building to accommodate the Museum. However, even after sufficient means are procured for the completion of this object, it is not enough for the interests of the Academy and Science that we should stop here. The Museum has now acquired such giant proportions that voluntary labor can no longer be depended upon for the arrangement of the cabinet; indeed, the Museum in its present unarranged and often confused condition, loses the greater part of its value to students. The time has arrived when it is highly important that means should be obtained to employ a Curator and competent assistants whose duty it shall be to classify, arrange, and label the collection and maintain it in perfect order.

The Museum of the Academy has become one of the most attractive places of visit in our city, and with its collections properly arranged and labelled will become a great school of popular instruction. During the past year, though open only, as usual, two half days weekly, it was visited by 51,520 persons.

If our city government appreciated the importance of the Academy as a school of instruction to the people, it could not hesitate to aid it in its object, by appropriating for its use, as has been repeatedly suggested, one of the public squares at Broad and Market Streets.

The following account exhibits the contributions to the Museum in its various departments during the year.

Mammals.—Fifteen specimens were presented by Dr. J. H. Slack, Dr. H. B. Butcher, U. S. A., S. Powell, Rev. Alden Grant, Mr. Reeves, Joseph E. Shaw, G. J. Durham, O. Biddle, W. S. Vaux, and E. D. Cope.

Birds.—One hundred and ninety-one from Alaska and Hudson Bay Territory, were presented by the Smithsonian Institution; 67 from Texas, by Dr. H. B. Butcher, U. S. A., and 43 species of birds, nests and eggs, were presented by Dr. William Zaremba, Dr. V. B. Hubbard, U. S. A., Rev. Alden 1867.]

Grout, Dr. George Smith, Mrs. Horace Fassitt, Capt. Thomas Clarkson, Mr. G. J. Durham, and Mr. W. S. Vaux.

Reptiles.—At different times Prof. E. D. Cope presented collections comprising together many species; and other collections were presented by Dr. George H. Horn, Mr. W. S. Vaux and Prof. M. Miles. Seven species were presented by Capt. R. B. Ely, Rev. E. R. Beadle, Mr. Robert Swift, Dr. C. W. Zaremba and Dr. E. J. Lewis.

Fishes.—Many species, fresh water and marine, were presented at different times by Prof. E. D. Cope, and a small collection from Surinam was presented by the Smithsonian Institution. Seven species were presented by Dr. G. H. Horn, Mr. E. Homan, Col. W. H. Yeaton, Dr. S. Ashhurst, Dr. Slack and Mr. J. D. Sergeant.

Mollusks.—Above all other departments of the Museum of the Academy, the conchological cabinet has been greatly enriched the past year. Mr. George W. Tryon, Jr., has deposited his collection of upwards 10,000 species, in addition to 100 jars of alcoholic specimens, mainly naked mollusks. Through this extensive addition the conchological collection of the Academy has become one of the largest in the world. Through the activity of the Conchological section of the Academy during the year, our cabinet has also received many available additions, for the details of which we refer to the report of the Conservator of that Section.

Articulates.—Small collections of crustacea, and a few specimens of insects, &c., were presented by Capt. Ely, Wm. M. Gabb, J. R. Thompson, E. R. Beadle, F. Guckert, Dr. G. R. McCoy, and R. Frazer.

Radiates.—Small collections were received from Robert Swift and W. M. Gabb, and specimens were presented by A. Black, A. C. Kline, J. Cassin, J. Harrod, and S. Powel.

Fossils.—Prof. E. D. Cope presented a valuable collection of remains of an extinct whale, *Eschrichtius cephalus*, a *Basilosaurus*, *B. atlanticus*, a new *B. mento*, and a number of rays, from the miocene formation of Maryland. Drs. Francis and Samuel Ashhurst also presented several collections comprising many fragments of bones of saurians, chelonians, and fishes, from the green sand of New Jersey. Dr. LeConte presented collections of remains of fishes, shells, and plants from the cretaceous and other formations of Kansas and New Mexico. Mr. William Brown, through William M. Gabb, presented a fine specimen consisting of the greater part of the skull of the great extinct *Bison antiquus*, from San Francisco, Cal., and Dr. Geo. H. Horn presented remains of an extinct horse, from California. Small collections of fossils and specimens were also presented by T. A. Conrad, Dr. S. B. Howell, Dr. N. M. Glatfelder, Dr. I. Hays, James W. Carson, W. H. Stevens, J. Krider, W. S. Vaux, P. W. Sheaffer, Dr. G. W. Hall, and Charles E. Smith.

Minerals.—Fifty-nine specimens were presented by I. Lea, W. S. Vaux, S. F. Peck, Rev. E. R. Beadle, W. H. Boyer, the Resolute Mining Co., B. A. Hoopes, Dr. J. L. LeConte, Dr. W. S. W. Ruschenberger, Wm. L. Mactier, Joseph Harrod, A. R. Leeds, A. C. Kline, Dr. G. Lincecum and E. J. Houdon.

Botany.—A collection of Australian plants was presented by Prof. Asa Gray, and collections of plants were presented by the Rev. Mr. Reeve and by Mrs. Carolina A. Hiester. Miscellaneous botanical specimens were presented by E. D. Kennedy, A. D. Jessup, Wm. M. Gabb, Joseph Harrod, T. Meehan and Miss Helen Blythe.

Comparative Anatomy.—Wm. M. Gabb presented eight skulls of California Indians, besides two other skulls. Fifteen skulls of mammals were presented by R. Swift, E. D. Cope and W. S. Vaux; and six miscellaneous anatomical specimens were presented by R. Swift, L. H. Deal, W. Taggart, and S. B. Howell.

[Dec.

Miscellaneous.—Dr. G. Lincoecum presented 36 jars of zoological specimens from Texas; Mr. Cope presented a collection of Indian relics; and an antique copper hammer from Lake Superior was presented by S. F. Peck. Miscellaneous specimens were presented by Jos. M. Valdespino, Dr. Shippen, J. R. Thompson, F. Dick, Dr. John C. Spear, U. S. A., F. Coxe, J. G. McClenahan, J. Cassin, H. Allen and S. B. Howell.

Respectfully submitted by

JOSEPH LEIDY,

Chairman of the Curators.

REPORT OF THE LIBRARIAN.

The Librarian most respectfully reports that the number of donations to the Library from January to December, 1867, inclusive, is 1681.

| | |
|--|-------------|
| Of these there were volumes..... | 380 |
| pamphlets..... | 1295 |
| maps..... | 6 |
| Total..... | 1681 |
| As follows: | |
| Folios..... | 28 |
| Quartos..... | 418 |
| Octavos..... | 1207 |
| Duodecimos..... | 22 |
| Maps..... | 6 |
| Total..... | 1681 |
| These were derived from the following sources: | |
| Editors..... | 157 |
| Authors..... | 209 |
| Societies..... | 629 |
| Library Fund..... | 201 |
| Wilson Fund..... | 160 |
| Geo. W. Tryon, Jr..... | 208 |
| Publishers..... | 8 |
| Minister of Public Works, France | 7 |
| Dr. Jos. Leidy..... | 4 |
| S. S. Haldeman..... | 17 |
| J. Gwyn Jeffreys..... | 14 |
| A. & H. Adams..... | 38 |
| Hon. Secretary of the Navy..... | 1 |
| Wm. S. Vaux..... | 1 |
| Treasury Department..... | 7 |
| U. S. Coast Survey..... | 1 |
| Smithsonian Institution..... | 6 |
| Geological Survey of India..... | 7 |
| Hon. Leonard Myers..... | 1 |
| Hon. Chas. Sumner..... | 1 |
| Mrs. Lucy W. Say..... | 1 |
| Chas. E. Smith..... | 1 |
| Surgeon General U. S. A..... | 2 |
| And were divided as follows: | |
| Anatomy and Physiology..... | 13 |
| Bibliography..... | 14 |
| Botany..... | 39 |
| Chemistry..... | 1 |
| Conchology..... | 328 |
| Entomology..... | 45 |
| General Natural History..... | 53 |
| Geology..... | 103 |
| Helminthology..... | 6 |
| Herpetology..... | 4 |
| Ichthyology..... | 8 |
| Journals..... | 959 |
| Languages..... | 3 |
| Mammalogy..... | 5 |
| Medicine..... | 19 |
| Mineralogy..... | 14 |
| Ornithology..... | 33 |
| Physical Science..... | 21 |
| Useful Arts..... | 1 |
| Voyages and Travels..... | 12 |
| Total..... | 1681 |
| Total..... | 1681 |

One hundred and sixty volumes and two hundred and thirty three pamphlets were presented through the Conchological Section of the Academy.

All of which is respectfully submitted.

J. D. SERGEANT.

1867.]

REPORT OF THE RECORDING SECRETARY.

During the year ending November 30th, 1867, there have been elected one hundred and eleven members and sixty-six correspondents.

The death of the following members and correspondents have been announced :

Ten members—namely : Mr. Edward F. Sanderson, Mr. Robett Kennicott, Mr. William Norris, Prof. Alex. D. Bache, Washington Sherman, M. D., C. W. Pennock, M. D., Mr. Samuel C. Morton, Miss Margaretta H. Morris, Mr. Jacob Pierce, Mr. Richard M. Marshall ;

Nine correspondents—namely : Rev. Stephen Elliott, Geo. W. Featherstonhaugh, Dr. Brackenridge Clemens, Prince Maximilian Zu Wied, Dr. Geo. Jager, Dr. C. M. Diesing, Prof. Faraday, Dr. Zimmerman, Rev. Dr. C. Dewey.

Three members have resigned.

The number of papers contributed and ordered to be printed in the Proceedings and Journal during the year has been thirty-six, as follows :

In the Proceedings thirty-three ; namely—

| | | | |
|------------------------|---|----------------------------|---|
| Aubrey H. Smith..... | 1 | G. C. Lincoecum, M.D..... | 1 |
| Thomas Meehan..... | 4 | J. H. Slack, M.D..... | 1 |
| E. D. Cope..... | 5 | H. C. Wood, Jr., M.D..... | 2 |
| Isaac Lea..... | 2 | John Cassin..... | 4 |
| Henry Shimer, M.D..... | 2 | Alphonso Wood..... | 1 |
| Jacob Ennis..... | 1 | Geo. N. Lawrence..... | 1 |
| D. G. Elliott..... | 1 | Elliott Cones, M.D..... | 1 |
| Richard Hill..... | 1 | John L. Le Conte, M.D..... | 4 |
| Geo. H. Horn, M.D..... | 2 | | |

In the Journal three ; namely—

E. D. Cope..... 3

All of which is respectfully submitted.

S. B. HOWELL, Recording Secretary.

The following reports were read from the Conchological Section :

REPORTS OF THE CONCHOLOGICAL SECTION.

REPORT OF THE SECRETARY.

The Conchological Section of the Academy of Natural Sciences would beg leave to report—

That the Section was organized by the election of officers, Dec. 6th, 1866. Six members and seventy-three correspondents have been elected during the year. Two members have resigned, and one correspondent has died. Meetings have been regularly held on the evening of the first Thursday of each month. Correspondence has been opened with scientific gentlemen in this country and abroad, as will be seen by the Secretary's report.

A number of articles on scientific subjects have been published, as well as consecutive numbers of the "American Journal of Conchology," and the "Monograph of Terrestrial Mollusca."

Donations to the library have been numerous, as noticed in report of the Librarian.

Additions to the collection during the year have been beyond all precedent in the number and value of specimens, as may be seen by the Conservator's report.

In conclusion, we venture to express the hope that, under the fostering care of the Academy, this Section may prove an efficient arm of the service, in carrying on the work which this noble institution is destined to accomplish for true science and the diffusion of knowledge.

E. R. BRADLE, Secretary.

[Dec.

REPORT OF THE CORRESPONDING SECRETARY.

Letters have been addressed to the following gentlemen, announcing their election as correspondents :

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| <p>Prof. Louis Agassiz, Cambridge, Mass. John G. Anthony, Cambridge, Mass. Geo. French Angus, Australia. Henry Adams, London. Arthur Adams, London. Thos. Bland, New York. H. Benson, Cheltenham, England. J. R. Bourguignat, Paris. Dr. August Baudon, Banvais, France. Luigi Benoit, Messina, Sicily. Hon. L. E. Chittenden, New York. Dr. P. L. Carpenter, Montreal, C. W. Col. F. F. Cavada, Tr. de Cuba. M. H. Crosse, Paris. Dr. J. C. Chenu, Paris. Hon. Edward Chitty, Jamaica. Fredk. Calliaud, Nantes, France. Dr. J. C. Cooper, San Francisco. Dr. J. C. Cox, N. S. W. M. G. P. Deshayes, Paris. Prof. Wm. Dunker, Marburg, Hesse. William H. De Camp, M. D., Grand Rapids, Mich. Henri Drouet, Troyes, France. Dr. Paul Fischer, Paris. Prof. Theo. Gill, Washington, D. C. Wm. M. Gabb, San Francisco. Prof. J. E. Gray, London. J. B. Gassies, Bordeaux, France. Dr. J. Gundlach, Havana, Cuba. Prof. James Hall, Albany, N. Y. Prof. F. S. Holmes, Charleston, S. C. Alpheus Hyatt, Salem, Mass. Sylvester Hanley, Middlesex, Eng. J. Gonzales Hidalgo, Madrid, Spain. J. C. Jay, M. D., Rye, N. Y. J. Gwyn Jeffries, London. J. P. Kirtland, M. D., Cleveland, O. Frederick Krauss, Stuttgart.</p> | <p>Dr. H. C. Küster, Cassel. James Lewis, M. D., Mohawk, N. Y. Prof. Albert Mousson, Zurich, Sw. Edward F. Morse, Salem, Mass. Prof. F. B. Meek, Washington, D. C. R. P. Montrouzier, New Caledonia. Arthur Morelet, Dijon, France. Prof. O. A. L. Mörck, Copenhagen. Jules Mabille, Dinan, France. Wesley Newcomb, M. D., Oakland, California. Temple Prime, New York. Patricio Maria Paz, Madrid, Spain. Dr. Louis Pfeiffer, Cassel. Prof. F. Poey, Havana, Cuba. Baron de Castello de Paiva, Lisbon. Dr. R. A. Philippi, Santiago, Cuba. M. C. Recluz, Paris. Wm. D. Stimpson, M. D., Chicago. E. R. Showalter, M. D., Uniontown, Alabama. Prof. G. B. Sowerby, London. Prof. D. S. Sheldon, Davenport, Iowa. Petit de la Saussaye, Paris. R. E. C. Stearns, San Francisco. Abbe Joseph Stabille, Milan. M. Souverbie, Bordeaux, France. J. H. Thompson, New Bedford, Mass. Prof. F. H. Troschell, Bonn, Prussia. A. P. Turver, Lyons, France. Professor George Ritter von Fraunfeld, Vienna. Prof. P. J. Van Beneden, Bruxelles, B. Prof. Van Mohrenstein, Vienna. Dr. Levi Vaillant, Paris. Prof. Van den Busch, Bremen. J. R. Willis, Halifax. Alex. Winchell, Ann Arbor, Mich.</p> |
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Letters have also been written to the following gentlemen :

April 22d, 1867.—W. T. Blandford, Calcutta, proposing an exchange of publications and specimens ;

Dr. Paladilhe, Montpellier, France ;
 Jules Mabille, Paris ; proposing exchanges.

May 7th.—D. Rafael Arango, Cuba, proposing an exchange of specimens.

Sept. 11th.—Hon. L. E. Chittenden, New York, accepting proposals to send shells.

Sept. 19th.—Sylvester Hanley, accepting proposals for an exchange ;
 W. T. Blandford, Calcutta, accepting proposals for an exchange.

Letters have been received from the following gentlemen, accepting of their election as correspondents :

May 9th.—D. S. Sheldon, Davenport, Iowa.

1867.]

May 11th.—James Lewis, M. D., Mohawk, N. Y. ; Wm. Stimpson, M. D., Chicago.

May 15th.—E. R. Showalter, M. D., Alabama.

May 18th.—J. G. Anthony, Cambridge, Mass.

May 23d.—Temple Prime, New York.

May 29th.—J. C. Jay, M. D., Rye, N. Y. ; F. C. Morse, Salem, Mass.

June 1st.—Thomas Bland, New York.

June 28th.—Alexander Winchell, Michigan.

July 12th.—Prof. Theodore Gill, Washington, D. C.

July 31st.—Col. F. F. Cavada, Cuba.

Aug. 12th.—Prof. F. B. Meek, Washington, D. C.

Letters have been received from the following gentlemen, offering to send shells or exchange specimens :

1867. Sept. 4th.—Hon. L. E. Chittenden, New York ; Sylvester Hanley, Middlesex, England.

Sept. 5th.—Prof. J. E. Gray, British Museum ; W. T. Blanford, Calcutta.

All of which is respectfully submitted.

E. R. BEADLE,
Corres. Sec'y.

Dec. 5, 1867.

REPORT OF THE CONSERVATOR.

The Conservator of the Conchological Section respectfully reports that the Conchological cabinet has been increased during the year by the following donations and purchases :

Geo. W. Tryon, Jr., presented six specimens of shells exhibiting internal structure ; *Magilis antiquus* from the Red Sea ; *Helix Parkerii* ; ninety-five species selected from the Poulson Collection, and about two hundred additional duplicate species from the same collection ; four specimens of Cephalopods, in spirits, and forty-eight species, numerous specimens of Australian shells, together with a collection of Cephalopods and other naked mollusks in spirits.

One hundred and eighty-four species of marine shells from Italy were received from Sylvanus Hanley ; one hundred and fifty-six species, three thousand nine hundred specimens of Unionidæ and *Melania* chiefly from Alabama, from E. R. Showalter, M. D. ; types of sixty-four species of Polynesian shells, described by W. H. Pease, were received from their describer. One hundred and six species, numerous specimens of shells from Canary Islands, Greenland, Arabia and Chili were presented by O. A. L. Mörch.

S. S. Haldeman presented his type specimens of the genera *Limnea*, *Planorbis* and *Physa*.

One hundred and four species of American terrestrial and fluviatile shells were received from E. Hall ; one hundred and twenty-two species, numerous specimens of Polynesian shells from Dr. J. C. Cox ; ninety-one species of shells from Australia, South America, Palestine, &c., from W. P. Wilstach. One hundred and forty species, numerous specimens of land and fresh-water shells, were presented by Aug. Brot, M. D., of Geneva.

Rev. E. R. Beadle presented a specimen of *Navea Newcombii*, a perforating *Haliotus*, from Lower California, three species of Cuban shells, and two specimens of *Pinna squamosa*, from the Mediterranean Sea, *Macra lateralis*, Say, *Voluta Turneri*, a large collection of *Solens*, *Macra*, &c., and five species of terrestrial shells from Syria and Java.

Thirty-one species, numerous specimens of Cuban land shells were received from Col. F. F. Cavada.

Collections were also presented by G. A. Lathrop, A. O. Currier, J. R. Willis, C. F. Parker, F. H. Aldrich, Wm. M. Gabb, Dr. Jos. Leidy, F. A. Randall, E. D. Cope, John Ford and Andrew J. Bennett.

Sixty-three species, numerous specimens, were received from Dr. E. W.

[Dec.

Fubbard, John Krider, J. E. Kehlman, S. R. Roberts, Dr. H. C. Wood, Jr., Isaac Lea, Geo. Scarborough, W. D. Hartman, M.D., Geo. H. Horn, M.D., John Cassin, Thos. Bland, Wesley Newcomb, Wm. S. Vaux, R. E. C. Stearns, Miss Anna Abbott, J. L. Julius, J. H. Redfield, Dr. James Lewis, and Jacob Knnis.

Types of Rafinesque's Unios, with the original labels in his handwriting, were obtained by purchase from the collection of the late Chas. A. Poulson.

In addition to the above, the magnificent collection of over one hundred thousand specimens of ten thousand species, deposited by Mr. Geo. W. Tryon, Jr., has been received and incorporated with the main collection, making our cabinet richer than any other in the world in specimens, and the richest in species with one exception, that of the British Museum.

A collection of one hundred and eight species of American shells has been sent to Dr. J. C. Cox, of Sydney, Australia, in exchange for Polynesian shells, received from him. A similar collection has been sent to M. Luigi Benoit, of Sicily, and a smaller one to M. Spiridione Brusina.

The various collections received during the year have been arranged, labelled and deposited in their proper places in the cabinet by Messrs. Geo. W. Tryon, Jr., Chas. F. Parker, S. R. Roberts and others, who have devoted much time and labor to the work. The proper systematic arrangement has been somewhat interfered with in consequence of the very limited accommodation afforded our magnificent collection in our present building, nor can any remedy for this inconvenience be at present suggested.

Dr. S. B. Howell has kindly undertaken the arrangement of our alcoholic collection, and has made considerable progress therein.

Opportunity having offered to acquire a portion of the collection of shells belonging to the late Hugh Cumming, of London, which portion consists of about one thousand species not yet in our museum, a subscription list was opened, and our appeal having been answered encouragingly, the shells were ordered, and some of them are now on their way to the Academy.

Although the Conchological Section of the Academy has been in existence but little over a year, yet an observation of its present condition cannot, we believe, fail to be gratifying to all interested in the science for the encouragement of which it was instituted. Whilst the augmentation of the collection during that time has been beyond all precedent, a reference to the list of our contributors will prove that the interest taken in the department is not confined to our members alone, but is manifested by others who are not so intimately connected with us, both at home and abroad.

In conclusion, we beg leave to congratulate those present that through their instrumentality, the interest heretofore manifested in our science has been greatly increased, and to hope that their efforts may be still farther successful in the future in gaining for Conchology that prominent position among the Natural Sciences which it so well deserves.

Respectfully submitted by

JOSEPH LEIDY, *Conservator.*

LIBRARIAN'S REPORT.

There have been presented during the past year to the Conchological Section of the Academy of Natural Sciences, 140 volumes, and 298 periodicals, Pamphlets, &c. Of these works, 195 are from Authors, 12 from Editors, 14 from Societies, 12 from Smithsonian Institution, 5 from Publication Committee of Conchological Section of the Academy of Natural Sciences, and 140 bound volumes, and 60 pamphlets, &c., from G. W. Tryon, Jr.

In addition to the above there have been presented to the Academy of Natural Sciences, 21 volumes, pamphlets, &c., on Conchological subjects.

Respectfully submitted.

C. F. PARKER.

Librarian.

The election of officers for the ensuing year was held in accordance with the By-Laws, with the following result :

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| <i>President</i> | ISAAC HAYS, M.D. |
| <i>Vice-Presidents</i> | Wm. S. Vaux, John Cassin. |
| <i>Corresponding Secretary</i> | Harrison Allen, M.D. |
| <i>Recording Secretary</i> | Samuel B. Howell, M.D. |
| <i>Treasurer</i> | Wm. C. Henszey. |
| <i>Librarian</i> | Edward J. Nolan, M.D. |
| <i>Curators</i> | Jos. Leidy M.D. Wm. S. Vaux, John Cassin, Edw. D. Cope. |
| <i>Auditors</i> | Jos. Jeanes, Wm. S. Vaux, Aubrey H. Smith. |
| <i>Publication Committee</i> | Jos. Leidy, M.D., Wm. S. Vaux, Robert Bridges, M.D. John Cassin, Geo. W. Tryon, Jr. |

The following were elected members :

J. Ronaldson Magee, Horace Magee, Isaac S. Waterman, A. J. Antelo, Wm. G. Moorhead, Richard K. Betts, George W. Brown, M.D., Henry R. Silliman, M.D., U.S.A., Edwin Sheppard, Jos. Willcox and Josiah W. Leeds.

ELECTIONS FOR 1867.

The following persons were elected Members—viz. :

Jan. 29.—J. E. Farnum, W. H. Stevens, Edw. B. Edwards, Jas. Levick, M.D., Chas. Gibbons, John B. Austin, Wm. S. Baird, Edwin Greble, Walter B. Smith, Wilson M. Jenkins, C. J. Haseltine.

Feb. 26.—Evans Randolph, Francis R. Cope, Joseph Patterson, Richard M. Marshall, Benjamin Marshall, John Livezey, Chas. H. Borie, Thos. P. Cope, Miss R. A. Cope, Mrs. E. H. Vaux, Jos. S. Lovering, Jr., Saml. P. Carpenter, Richard R. Robb, Wm. Hacker, Stephen Colwell, Miss Ann Haines, Miss Jane R. Haines, F. L. Bodine, Horace M. Bellows, M. D., John G. Stetler, M. D., Wm. Procter, Jr., Anthony Heger, M. D., U.S.A.

March 26.—Samuel Ashhurst, M.D., Francis Ashhurst, M.D., Rev. J. L. Beman, Chas. Smith, Thomas Karp, Charles Taylor, Moro Phillips, Samuel Welsh, Lewis Cooper, Benj. B. Comegys, S. C. Morton, Mrs. E. P. Long, Miss Bohlen.

April 30.—Wm. Hay, Jas. H. Little, Beaveau Borie, J. Ross Snowden, Wm. W. Keen, Jr., M.D., Edw. J. Nolan, M.D., Chas. Magarge, Chas. S. Coxe, I. V. Williamson, Matthew Baird, Chas. Wheeler, Robert H. Gratz, Adolph E. Borie, H. Pratt McKean, George F. Tyler, Wistar Morris, Jos. E. Page, Israel Morris, A. Campbell, Thos. A. Scott, H. H. Houston, Chas. Spencer, Gustavus S. Benson, Wm. A. Blanchard.

May 28.—Asa Whitney, Geo. Whitney, Jno. R. Whitney, E. W. Clark, Clarence H. Clark, Frank H. Clark, Theo. H. Morris, O. N. Beach, Jas. N. Whelen, Wm. A. Whelen, Alexander Whildin, Orlando Crease, Andrew I. Sloan, D. Murray Cheston, M.D., Edw. C. Knight, C. P. Bayard, Jay Cooke, A. J. Drexel, Jas. A. Wright, John T. Taitt, Jr., John Baird, Thos. Clyde, John B. Trevor, Thomas Potter, Frank Haseltine, Clarence S. Bement, Danl. H. Rockhill, Franklin S. Wilson, Rev. J. C. Ralston, Wm. R. White.

June 25.—S. Morris Waln, B. Hammit.

July 30.—Henry C. Gibson, Andrew M. Moore, John Gibson, T. Brantly Langdon.

Aug. 27.—James K. Tyson, M.D., Wm. Pepper, M.D., Geo. Pepper, M.D., Horace Binney Hare, M.D., Elias D. Kennedy.

Sept. 24.—A. G. Hinkle, M.D., Chas. H. Thomas, M.D.

Oct. 29.—Chas. W. Matthews.

Nov. 26.—Edw. R. Murphy, Lloyd P. Smith, F. A. Hassler, M.D., G. Y. Shoemaker, Matthew Newkirk.

Dec. 31.—J. Ronaldson Magee, Horace Magee, Isaac S. Waterman, A. J. Antelo, Wm. G. Moorhead, Richard K. Betts, Geo. W. Brown, M.D., Henry R. Silliman, M.D., U.S.A., Edwin Sheppard, Jos. Willcox, Josiah W. Leeds.

The following were elected Correspondents—viz. :

Jan. 25.—Prof. O. C. Marsh, of New Haven, Conn. ; Prof. Wm. H. Brewer, of New Haven, Conn.

March 26.—John R. Willis, of Halifax, N. S. ; Gideon Lincecum, of Long Point, Texas ; Samuel H. Soudder, M.D., of Boston ; Hon. Geo. P. Marsh, of Florence, Italy.

April 30.—Col. Frederick F. Cavada, U. S. Consul at Trinidad de Cuba ; Eugene Gaussoin, Ph.D., of Baltimore, Md. ; Alpheus Hyatt, of Salem, Mass. ; F. W. Putnam, of Salem, Mass.

May 28.—E. E. Adams, D.D. ; D. Antonio Raimondi, M.D., of Lima, Peru ; Alexander Winchell, of Ann Arbor, Mich. ; Henry Pleasants, of Pottsville, Penn.

June 25.—C. William Zaremba, of St. Joseph's, Mich. ; H. E. Dresser, of London ; M. H. Crosse, of Paris ; Paul Fischer, M.D., of Paris ; M. J. R. Bourguignat, of Paris ; R. P. Montrouzier, of New Caledonia ; George French Angas, of Port Jackson, Australia ; Henry Adams and Arthur Adams, of London ; J. C. Chenu, M.D., of Paris ; Hon. Edw. Chitty, of Kingston, Jamaica ; J. B. Gassies, of Bordeaux ; Sylvanus Hanley, of London ; J. Gwynn Jeffreys, of London ; Dr. H. C. Küster, of Cassel ; Arthur Morelet, of Dijon ; Dr. Louis Pfeiffer, of Cassel ; Prof. O. A. L. Mörch, of Copenhagen ; Prof. F. H. Troschel, of Bonn, Prussia ; G. S. von Mohrenstern, of Vienna ; Frederick Caillaud, of Nantes ; A. P. Terver, of Lyons ; Petit de la Saussaye, of Paris ; Wesley Newcomb, M.D., of Oakland, Cal. ; Dr. J. G. Cooper, of San Francisco ; R. E. C. Stearns, of San Francisco ; Prof. F. Poey, of Havana ; Dr. J. Gundlach, of Havana ; Dr. R. A. Philippi, of Santiago, Chili ; H. Benson, of Cheltenham, England ; Henri Drouet, of Troyes ; Dr. Aug. Baudon, of Beauvais, France ; M. C. Recluz, of Vaugirard, near Paris ; Dr. Leon Vaillant, of Paris ; Baron de Castello de Paiva, of Lisbon ; Dr. G. Von dem Busch, of Bremen ; J. C. Cox, of Sydney N. S. W. ; Jules Mabille, of Dinon, France ; Luigi Benoit, of Messina ; J. Gonzales Hidalgo, of Madrid ; Abbe Joseph Stabile, of Milan ; M. Souverbie, of Bordeaux.

July 30.—Rev. E. Johnson, of Sandwich Islands.

Aug. 27.—Geo. J. Durham, of Austin, Texas ; John Henry Gurney, of Norfolk, Eng. ; Osbert Salvin, of London ; T. C. Jerdon, M.D., of Madras, India ; Prof. J. Reinhardt, of Copenhagen, Denmark.

Sept. 24.—Alphonso Wood, of West Farms, N. Y.

Nov. 26.—Wm. S. Bingham, of Boston ; Prof. O. Root, of Hamilton College, N. Y. ; Col. E. Jewett, of Utica, N. Y.

CORRESPONDENCE OF THE ACADEMY.

For 1867.

Letters were received and read as follows :

- January 29th.*—Physicalisch Medicinische Gesellschaft, Sept. 7, 1866 ;
 Naturforschende Gesellschaft des Osterlande, Altenburg, Oct. 18, 1866 ;
 K. K. Geologische Reichsanstalt, Vienna, Sept. 30, 1866 ;
 K. Gesellschaft für Wissenschaften, Göttingen, severally acknowledging receipt of Proceedings.
 Naturforschende Gesellschaft in Emden, Oct. 1, 1866 ;
 Wissenschaftliche Verein, Luneburg, Oct. 1, 1866 ;
 Naturkundige Gesellschaft in Wurttemberg, Stuttgart, Aug. 1, 1866, acknowledging receipt of Proceedings and transmitting publications.
 Entomological Society, Paris, Dec. 22, 1866 ;
 Naturforschende Gesellschaft zu Halle, Sept. 23, 1866 ;
 Mannheim Verein für Naturkunde, Oct., 1866, severally transmitting their publication.
 Smithsonian Institution, Washington, D. C., Oct. 8, 1866, acknowledging receipt of Journal.
 Review of the Literary and Scientific Course, Paris, Dec. 20, 1866, accepting exchange upon certain conditions.

February 26th.—H. C. Wood, Jr., M. D., tendering his resignation as Recording Secretary.

Jos. Jeanes, resigning his position as Corresponding Secretary.

Jos Starr, tendering his resignation as a member of the Academy.

Recorder of the Conchological Section, announcing their organization and election of officers.

April 23d—Captain Snow, offering his services to the Academy as lecturer.

April 30th.—J. Vaughan Merrick, Apr. 29, asking co-operation on the part of the Academy in the erection of new buildings for the combined scientific societies of Philadelphia.

Finance Committee of the Lyceum of Natural History of William's College, asking co-operation in a scientific expedition to South America.

J. M. S. Thackara, and Samuel H. Scudder, M.D., acknowledging receipts of notifications of election.

May 28th.—J. Ross Snowden, acknowledging his election as member.

June 25th.—Geo. W. Tryon, Jr., June 18th, accompanying the deposit of his collection of shells.

Also the following :

Wm. Procter, Jr., Phila., March 4th, 1867 ;

A. Heger, M. D., U. S. A., New York, March 7, 1867 ;

Jas. H. Little, Buckingham P. O., June 19th, 1867 ;

E. W. Clark, Philadelphia, July 16th, 1867 ;

L. H. Carpenter, Austin, Texas, Sept. 20th, 1866 ;

Horace B. Hare, M. D., Philadelphia, Aug. 28th, 1867, severally acknowledging their election as members of the Academy.

Abbé Joseph Stabile, Milan, Feb. 9th, 1867 ;

Samuel Scudder, Boston, April 8th, 1867 ;

Geo. P. Marsh, Florence, April 20th, 1867 ;

Edw. L. Berthoud, Golden City, May 22d, 1867 ; severally acknowledging their election as correspondents of the Academy.

Royal Society of Edinburgh, Jan. 10th, 1867 ; acknowledging receipt of Proceedings.

A. H. Smith, M. D., U. S. A., Harts Island, Jan. 24th, 1867, requesting information respecting membership.

J. A. Heintzleman, Feb. 6th, 1867, tendering his resignation of membership.

Oliver W. Barnes, Feb. 19th, 1867, tendering his resignation of membership.

W. H. Dau, Fort St. Michaels, Sept. 30th, 1866, informing the Academy of the death of R. Kennicott.

T. Morris Perot, Feb. 1st, 1867, transmitting petition memorializing Congress upon the subject of importation of books for public libraries free from tariff rates.

Dr. Wm. Zaremba, March 14th, 1867, making inquiry relative to donations, &c. ; April 1st, requesting copy of by-laws.

Chas. H. Doerflinger, March 15th, 1867, transmitting donation to library.

L. W. Schmidt, March 21st, 1867, transmitting copies of his catalogue of books.

Fred'k. Fraley, Phila., March 20th, 1867, regarding the funeral expenses of Prof. Dallas Bache.

American Bureau of Mines, New York, April 18th, 1867, regarding cost of Proceeding.

James Hall, Albany, April 27th, 1867, in reference to a donation to the library.

Chas. Murray, January 26th, 1867, transmitting donation to Library.

Alexander Winchell, Ann Arbor, June 28th, 1867 ;

Eugene Gaussoin, Baltimore, July 19th, 1867 ;

F. F. Cavada, Trinidad, July 31st, 1867 ;

- J. Gwynn Jeffreys, London, August 31st, 1867 ;
 Henry Pleasants, Pottsville, Sept. 6th, 1867 ;
 S. Wylie Crawford, Louisville, Ky., Sept. 22d, 1867 ;
 M. Henri Drœuet, Dijon, Sept. 13th, 1867 ;
 R. E. C. Stearns, San Francisco, Cal., Sept. 30th, 1867 ;
 M. Souverbie, Bordeaux, Sept. 13th, 1867 ;
 M. A. Moretel, Dijon, Sept. 7th, 1867 ;
 A. Baudon, Mony, Sept. 6th, 1867 ;
 M. Cailliaud, Nantes, October 13th, 1867 ;
 Henry Adams, London, Oct. 3d, 1867 ;
 C. C. Gray, M. D., U. S. A., Fort Stevens, Oct. 20th, 1867 ;
 M. Crosse, Paris, Nov. 8th, 1867 ;
 Chas. Stodder, Boston, Dec. 14th, 1867 ;
 Dr. P. Fischer, Paris, severally acknowledging their elections as correspondents of the Academy.
 Mrs. Willard Parker, New York, Jan. 8th and 14th, 1867 ;
 A. H. Smith, M. D., U. S. A., New York, May 10th, 1867 ;
 C. W. Zaremba, St. Josephs, May 7th, 1867 ;
 John C. Spear, M. D., Washington, D. C., May 30th, 1866 ;
 Smithsonian Institution, Washington, D. C., May 29th, 1867 ;
 Thos. Clarkson, Sagua la Grande, Cuba, Aug. 26th, 1867 ;
 Samuel Powel, Newport, R. I., July 3d, 1867, severally transmitting donations to the Museum.
 A. S. Packard, Salem, Mass., Dec. 20th, 1866, requesting contributions to American Naturalist.
 John K. Ralston, Norristown, Pa., June 5th, 1867, relative to election of Rev. I. Grier Ralston.
 A. M. Edwards, New York, July 18th, 1867, requesting names of members desirous of co-operation with the writer in studying Diatomaceae and Desmidiaceae.
 W. H. Seat, July 24th, 1867, regarding donations to Soule University.
 M. Seriziat, Strasbourg, requesting orders for impressions of Lepidopterous Insects.
 John W. Glass, Cincinnati, Ohio, Sept. 1st, 1867, offering for sale specimens of natural history in his possession.
 W. H. Dall, Fort Michaels, Aug. 14th, 1867, giving account of operations of Scientific Corps for past year.
 Royal Society of London, Sept. 29th, 1867, announcing the death of Prof. Michael Faraday.

DONATIONS TO THE MUSEUM.

1867.

- Abbott, Miss Anna. *Sept. 5th.* One fine specimen of *Venus interpurpurea*, Conrad, from Florida. Through the Conchological Section.
 Aldrich, F. H. *March 12th.* Twenty-eight species of Land and Fresh Water Shells, collected in the vicinity of Troy, N. Y. Through the Conchological Section.
 Allen, Dr. H. See Cassin.
 Ashhurst, Dr. S. *July 23d.* An alcoholic specimen of the Ribbon Fish (*Trichiurus lepturus*), from Egg Harbor, N. J.

- Ashhurst, Francis, M. D. *Aug. 6th.* A collection of Saurian, Chelonian and Fish Bones, and some fine specimens of Teeth of *Bottosaurus*, from the Green Sand of Pemberton, N. J. *Dec. 3d.* A collection of remains of Fishes and Reptiles, from same locality.
- Beadle, Rev. E. R. *March 7th.* *Navea Newcombii*, Tryon; perforating *Haliothis*, from Lower California. *Sept. 5th.* Three species of Cuban Shells, and two specimens of *Pinna squamosa*, Lam. From the Mediterranean Sea. *Dec. 5th.* *Mactra lateralis*, Say; *Voluta Turneri*; a large collection of *Solens* and *Mactrae*, &c.; also five species of Terrestrial Shells, from Syria and Java. Through the Conchological Section. *Feb. 12th.* Twenty specimens of Minerals, principally very fine specimens of Gypsum, from Iowa and Michigan. *Oct. 22d.* A large mass of Fossil Foraminifera, from Syria; Skin of a large Serpent, from South Africa. *Dec. 3d.* Female of *Termes fatalis*, from Ceylon.
- Bennett, And. J. *Dec. 5th.* Twenty-three species of Unionidæ, from the Sciota River. Through the Conchological Section.
- Biddle, Owen. *Aug. 13th.* Specimen of a common Bat.
- Bland, Thos. *June 6th.* *Helix uvulifera*, *H. cereolus*, *H. Postelliana*. Through the Conchological Section.
- Blythe, Miss Helen. *Sept. 24th.* Section of wood, cut by the beaver, from Lake Superior.
- Boyer, W. H. *Oct. 15th.* Epidote, Micaceous Iron and a fine specimen of Native Silver, from Michigan; Quartz with Feldspar Crystal, Native Copper, and specimen of Magnetic Oxide of Iron, Michigan.
- Brot, Aug. *Oct. 3d.* One hundred and forty species, numerous specimens of Land and Fresh Water Shells. Through the Conchological Section.
- Butcher, Henry B., M. D. (U. S. Army.) *Aug. 20th.* Sixty-seven specimens Birds and two specimens Quadrupeds, from Laredo, Texas.
- Carson, J. W. *Dec. 10th.* Large mass of Silicified Wood, from South Park, Colorado. Presented by Messrs. Carson and Stevens.
- Cassin, John. *June 6th.* *Purpura patula*. Through the Conchological Section. *Aug. 20th.* *Sciurus rubricaudatus*, Aud. and Bach.; Audubon's type. *Oct. 22d.* A small collection of Marine Animals, from Atlantic City. Presented by Messrs. Cassin, Allen and Howell. *Dec. 3d.* Two *Euphyllia pavonina*, West Africa.
- Cavada, Col. F. F. *March 12th.* Five species of Cuban Land Shells. *April 4th.* Twenty-six species, numerous specimens of Cuban Land and Fresh Water Shells. Through the Conchological Section.
- Clarkson, Capt. Thomas. *Oct. 8th.* Specimens of American Flamingo, *Phœnicopterus ruber*, from South America.
- Collection of Crustacea, Echinoderm, and Corals, from St. Bartholomew, W. I. *April 9th.* In exchange.
- Conrad, T. A. *April 9th.* Fossil Tooth of a Crocodile, from Barnsboro', N. J. *July 16th.* Collections of Fossils of the Hamilton Group, N. Y. *Aug. 6th.* A large *Septaria*, from Mt. Morris, N. J.
- Cope, E. D. *Sept. 5th.* A collection of Unios and other Fresh Water and Land Shells, from White Sulphur Springs, Giles Co., Va. *Nov. 7th.* Specimens of *Anculosa subglobosa*, Say, and *Melania simplex*; eight species of Unio and *Margaritana*, from Holston Riv., Va. Through the Conchological Section. *Jan. 15th.* A collection of Fresh Water Fishes. *Jan. 22d.* Thirty-four jars of Reptiles. *Feb. 19th.* A collection of forty specimens of twenty-one species of Marine Fishes, from St. Kitts Island, West Indies. *Dec. 10th.* Nine species, twenty specimens of Reptiles, from near the city of Guatemala: five species, fifteen specimens of Fishes, from near the city of Guatemala; thirty-three species, fifty-six specimens of Reptiles, from Bahia, Brazil; an Armadillo, from Bahia; a Jaguar Skull, from Brazil; and a Bear Skull, from Monterey, Cal. *Nov. 6th.* Remains of an extinct whale, *Eschrichtius cephalus*, of a *Basilosaurus*, *B. atlanticus*, and of a *Squalodon mento*, from the miocene of Charles County, Md.; a

- collection of Indian Relics, from Charles Co., Md.; ten species Unionids, one Anculosa, and one Goniobasis, from Holston R., Va. *Nov. 12th.* A collection of Palatine Teeth of *Aetobatis arcuatus*, Ag.; *A. profundes*, Cope; *Myliobatis gigas*, Cope; *M. vicomicanus*, Cope, Charles Co. Md.; and *M. pachyodon*.
- Cox, Dr. J. C. *June 6th.* One hundred and twenty-two species, numerous specimens of Polynesian Shells. Through the Conchological Section.
- Currier, O. C. *Feb. 7th.* *Anodonta subcarinata*, Currier; *Physa deformis*, Currier; *Melantho gibba*, Currier; *Bulimus Tryoni*, Currier, types of new species. *May 7th.* Thirty-nine species Shells, from Grand Rapids, Mich. *May 2d.* Thirty-nine species, numerous specimens, from Grand Rapids, Mich. Through the Conchological Section.
- Deal, Dr. L. H., *Sept. 17th.* Large Hair Ball, from the stomach of a calf.
- Dick, F. *Jan. 22d.* An Indian Stone Axe, from Billingsport, N. J.
- Durham, Geo. J. *Sept. 10th* Skin of a *Spermophilus Buckleyi*, Slack, from Austin, Texas. *Aug. 20th.* Head of *Mycteria Americana*, from near Austin, Texas; first ever obtained in the United States.
- Ely, Capt. R. B. *Jan. 1st.* *Bothrops lanceolatus* and a large Locust, from Michigan.
- Eshleman, J. B. *Feb. 7th.* *Melanio altitis*, Lea. Through the Conchological Section.
- Ennis, Jacob. *Dec. 5th.* *Vivipara lineata*, Val., from St. John's River, Florida. Through the Conchological Section.
- Ford, John. *Sept. 5th.* Beautiful suites of specimens of *Unio nasuta*, *U. complanatus*, *U. heterodon*, *U. ochraceus*, *Margaritana undulata*, *Anodonta undulata*, and *Sphærium transversum*, from Twenty-seventh Ward, Philadelphia. Through the Conchological Section.
- Gabb, W. M. *April 4th.* Fourteen species of Fresh Water Shells, from California. *May 7th.* A species of *Limnea*, and *Helix Hornii*, Gabb. Through the Conchological Section.
- Glatfelder, Dr. Noah M. *Jan. 1st.* Slab of Stone with Crystals of Selenite, a small collection of Fossils, and another of recent Plants, from Dakota.
- Graut, Alden. *Jan. 15th.* Five species of Birds, and one Mammal, from Natal Africa.
- Grey, Prof. Asa. *Dec. 10th.* A collection of Plants of Australia.
- Haldeman, S. S. *May 7th.* Type specimens of the Genus *Limnea*. *June 6th.* Type specimens of *Planorbis* and *Physa*. Through the Conchological Section.
- Hall, E. *May 7th.* One hundred and four species of American Terrestrial and Fluvial Shells. Through the Conchological Section.
- Hall, Geo. W., M.D. Fossil Tooth of a Tapir, from Illinois.
- Hanly, Sylv. *Feb. 12th.* One hundred and eighty-four species of Marine Shells, from Italy. Through the Conchological Section.
- Hays, Dr. I. *March 26th.* Tooth of a *Charcharodon* in the matrix, from Japan.
- Harrod, Joseph. *Nov. 19th.* Sheath of a Palm, Isthmus of Panama; Lichen from the Sequoia, and Fruit of the same, Calaveras Co., Cal.; Ivory Nut, Costa Rica; Sponge, from Nassau, B. I.; Geyserite, from the Geyser of California.
- Hartman, Dr. Wm. D. *May 2d.* Three species of Shells. Through the Conchological Section.
- Heister, Mrs. Caroline A. *Feb. 19th.* A collection of European Plants of the late Dr. John P. Heister, of Reading.
- Homan, E. *Sept. 3d.* A Sting Ray, from Atlantic City.
- Hoopes, B. A. *Oct. 22d.* Boulder of Native Copper, from Vulcan Mine, Lake Superior.
- Horn, Dr. Geo. H. *May 7th.* Five species of Shells, from Texas. Through the Conchological Section.

- Houston, E. J.** *April 7th.* Large specimen of Cyanite, from Leiperville, Del. Co.
- Hubbard, Dr. E. W.** *Jan. 8th.* *Helix Jacksonii*, Bland, from Fort Gibson, Indian Territory. Through the Conchological Section.
- Hubbard, V. B., M. D.** *Sept. 10th.* *Milvulus forficatus*, male and female, fine specimens, from the country of the Cherokee Nation.
- Howell, Dr. S. B.** *Jan. 1st.* Vertebra of a Whale.
- Julius, J. L.** *Oct. 3d.* One specimen of Cassis, from Trinidad. Through the Conchological Section.
- Kline, A. C.** *Nov. 12th.* A Red Coral.
- Krider, John.** *Jan. 8th.* Six species of American Land Shells. Through the Conchological Section.
- Lathrop, G. A.** *Jan. 8th.* Eighty-four species of Shells, from Saginaw River, Mich., and its vicinity. Through the Conchological Section.
- Lea, Isaac.** *April 4th.* *Septifer Trautwiniana*, type; *Columna Hainesii*, *Helix Peliomphila*, from Japan, &c. Through the Conchological Section. *Jan. 8th.* Specimen of Kaolin, from near Kennett's Square, Chester Co., Pa. *April 16th* Lesleyite with Pattersonite, and Pattersonite, Chester Co., Pa. *Nov. 5th.* Vermiculite, Lenni, Del. Co.; Muronite, near West Chester. *Dec. 3d.* Large specimen of Raphylite, Del. Co.
- Le Conte, J. L.** *Jan. 1st.* Teeth of *Ptychodus*; *Lamna*, *Galeocerdo*, and other Teeth and Bones of Fishes, from the cretaceous formation of Western Kansas—near Big Creek and Bunker Hill, 60 and 35 miles North-west of Fort Ellsworth; Crystals of Selenite, near Big Creek, Fossil Creek; Crystals of Barytes from Geodes, near Pond Creek, Kansas; collection of Dicotyledonous leaves, from the cretaceous formation, near Fort Ellsworth; Rocks and Fossil Shells, from along Smoky Hill Fork; Lignite, from cretaceous beds of Kansas. *Nov. 19th.* A collection of Remains of Fishes, from the cretaceous of Smoky Hill River, and chiefly from Fort Wallace: Fossil Shark Teeth, from near Fort Lyon. *Dec. 3d.* Fossil Remains of Fishes, from near Fort Wallace, Kansas; a small collection of Fossil Shells, from Kansas and New Mexico; a specimen of Turquoise, from Cerrites, near Santa Fé. *Dec. 10th.* A collection of Fossil Shells, from Kansas and New Mexico.
- Leeds, A. R.** *Nov. 5th.* Mica, Buncombe Co., N. C.
- Leidy, Dr. Jos.** *May 2d.* One species of *Spherium*. *Sept. 5th.* Eleven species of land and fresh-water Shells from Western Virginia. Through the Conchological Section. *Aug. 13th.* Specimen of *Pumiscaria glomeratus*. Atlantic City.
- Lewis, E. J., M.D.** *Oct. 8th.* Land Tortoise, marked with date of 1829. *Dec. 5th.* Four species of *Amnicola* from Mohawk. Through the Conchological Section.
- Lincecum, Dr. Gideon**, of Texas. *April 9th.* Thirty-six jars, vials, and boxes, containing a Collection of Zoological specimens. Fourteen bottles, containing a collection of Reptiles, Spiders, &c. From Long Point, Texas. *Dec. 3d.* Specimen of White Clay, from Texas.
- Mactier, Wm. L.** *Aug. 6th.* A collection of six specimens of native Copper, with Malachite and Calcite, from Lake Superior, and a specimen of Peat from Ireland.
- Matthews, C. W.** *Dec. 3d.* Tooth of *Carcharodon*. From Linnes Co., Miss.
- McClenahan, John.** *Jan. 1st.* Sandstone concretion, assuming the form of a snake's head, from North Carolina.
- Meehan, T.** *Dec. 17th.* *Liatris intermedia*.
- Mörch, Dr. Otto A. L.** *May 7th.* One hundred and six species, numerous specimens of Shells from the Canary Islands, Greenland, Arabia and Chili. Through the Conchological Section.
- McCoy, Dr. G. R.** *Sept. 10th.* Specimen of *Amblyopsis* and an *Astacus*, from Mammoth Cave, Kent.
- Miles, Prof. M.** *Jan. 22d.* A collection of Reptiles.

- Newcomb, W. *Sept. 5th.* Six species, fifteen specimens of Shells. Through the Conchological Section.
- Parker, C. F. *Feb. 12th.* Eight species of Shells new to the Collection. *March 12th.* *Pirenella turritella*, Brug. From New Zealand. *May 7th.* Three species and eleven sections of Shells. *Nov. 7th.* Two species of Shells, *Amphidesma* and *Thracia*. *Dec. 5th.* One species of *Ranella* and one of *Pleurotoma*, from Panama. Through the Conchological Section.
- Pease, W. H. *April 4th.* Types of nine new species. *Nov. 7th.* Types of fifty-five species of Polynesian Shells described by him. Through the Conchological Section.
- Peck, S. F. *Sept. 24th.* Antique Hammer of Native Copper, from the Bohemian Mine, Greenland, Michigan, and a fragment of Copper anciently mined, found with the former.
- Powel, S. *Jan. 15th.* A Sponge and Sertularian from Newport, R. I. *July 16th.* A Porpoise, *Phocoena brachicium*.
- Rafinesque type collection of Unios from the collection of the late C. A. Poulson. Types of Rafinesque's species, with the original labels in his handwriting. Purchased and presented through the Conchological Section.
- Randall, F. A. *Jan. 8th.* Three species Unio, from the Alleghany River. *Sept. 5th.* Ten species, numerous specimens of fresh-water Shells from Alleghany River. Through the Conchological Section.
- Redfield, J. H. *Nov. 7th.* Four species of *Marginella*. Through the Conchological Section.
- Resolute Mining Co. *Oct. 22d.* Crystallized Native Copper and Calcite from the Resolute Mine, Lake Superior.
- Roberts, S. R. *Feb. 12th.* Four species *Cyprea*, new to the Collection. One specimen *C. zigzag*. *May 7th.* *Anodonta papyracea* (Anth.), Tennessee. Through the Conchological Section.
- Ruschenberger, Dr. W. S. W. *Jan. 1st.* Fourteen Moonstones, from Ceylon.
- Scarborough, Geo. *April 4th.* Two species of Shells. Through the Conchological Section.
- Sellers, G. E. *Oct. 22d.* A collection of Fossils, from the vicinity of Cincinnati.
- Sergeant, J. D. *Dec. 17th.* One specimen *Mallotus*, Middle Atlantic Ocean.
- Shippen, Dr. *Nov. 19th.* A bent slab of Marble.
- Slack, Dr. J. H. *Jan. 1st.* Specimens of *Hesperomys Michiganensis*, *Sciurus Hudsonius*, and *Tamias quadrivittatus*; also specimens of *Esox*. *Nov. 19th.* *Pteropus Edwardsii*.
- Shaw, Joseph E. *Sept. 3d.* A specimen of brown Bat (*Scotophilus fuscus*).
- Sheafer, P. W. *March 26th.* Specimens of black band Iron Ore, from Mill Creek Shaft, near Pottsville, Penna., with impressions of *Sigillaria*.
- Showalter, E. R. *April 4th.* One hundred and fifty-six species, 3900 specimens of *Unionidæ* and *Melania*, chiefly from Alabama. Through the Conchological Section.
- Smith, C. E. *Sept. 10th.* Tufacious Moss, from Niagara.
- Smith, George, M.D. *Oct. 8th.* Specimen of the Osprey, or fish-hawk, *Pandion carolinensis*, from Haverford, Delaware Co., Pa.
- Smithsonian Institution. *Sept. 17th.* *Anser Rossii*, *Lestris Buffoni*, 2 *Somateria*, *V. nigra*, and 187 skins of Birds, principally from Sitka, Alaska Territory, and the Hudson Bay Co. Territories.
- Stearns, R. E. C. *Sept. 5th.* Seven species, numerous specimens, from California. Through the Conchological Section.
- Stevens, W. H. See Carson Dec. 10th.
- Swift, Robt. *Jan. 8th.* Skulls of the Capybara, Two-toed Sloth, Fox, Cat, Squirrel, and six Apes; three dilated hyoids of the Howling Monkey; 12 Star-fishes; Echini, Spatangii; 8 species and a Sea Fan. From St. Thomas, W. I., and South America. *Nov. 12th.* *Thecadactylus rassaicauda*. St. Thomas, W. I.

- Taggart, W. *Sept. 17th.* Embryo of the Black Snake.
- Thompson, J. H. *Feb. 12th.* *Helix Stuartiæ*, Sowb., from the Philippines.
- April 4th.* Type of *Montacuta Gouldii*. Through the Conchological Section.
- Thomson, J. R. *Oct. 8th.* A small collection of Crustacea; an Oestrus Larva from the back of a Cow.
- Tryon, Geo. W., Jr. *Feb. 12th.* Six specimens of Shells, exhibiting internal structure; *Magilis antiquus* from the Red Sea; *Helix Parkeri*, from Central America, &c. *March 12th.* Ninety-five species of Shells selected from the Poulson Collection; also about 200 duplicate species from the same Collection. *April 4th.* Four specimens of Cephalopods in spirits. *Sept. 5th.* Forty-eight species, numerous specimens of Australian Shells, together with a collection of Cephalopods and other naked Mollusks in spirits. Through the Conchological Section.
- Valdespino, Jno. M. *Oct. 8th.* Native Blanket of the Bark of the Damaqua Tree of Brazil.
- Vaux, W. S. *Sept. 5th.* *Bulimus* from Peru. Through the Conchological Section. *Feb. 12th.* Very fine specimen of Satin Spar, from Alston Moor, Cumberland, England. *March 12th.* Breccia with Remains of Reindeer, Horse and worked Flints. From Dordogne, France. A *Limulus* and *Eryon arctiformis*, in lithographic slate. Solenhofen, Bavaria. *Nov. 12th.* Fluor Spar with Spathic Iron. Cumberland, England. *Dec. 10th.* Fifteen species, 33 specimens Reptiles from near City of Guatemala. Skin of *Galictis vitata*, and a rodent Skull, Brazil; young King Vulture of Mexico. *Dec. 17th.* One specimen of Octopus, from Pacific coast, Guatemala.
- Willis, J. R. *Feb. 12th.* Twenty species of Marine Shells from Nova Scotia. Through the Conchological Section.
- Wilstach, W. P. *Aug. 6th.* Ninety-one species of Shells, from Australia, S. America, Palestine, etc. Through the Conchological Section.
- Wood, Dr. H. C., Jr. *March 12th.* Four species of land Shells, from Texas. Through the Conchological Section.
- Zaremba, Dr. Wm. *Aug. 20th.* Collection of Nests and Eggs of Birds of 15 species, from St. Josephs, Michigan.

DONATIONS TO THE LIBRARY.

1867.

JOURNALS AND PERIODICALS.

SWEDEN.

Upsalæ. *Nova Acta Regiæ Societatis Scientiarum Upsaliensis. Seriei Tertię.* Vol. VI., Fasc. Prior, 1866. From the Society.

DENMARK.

Kjøbenhavn. *Oversigt over det Kongelige danske Videnskabernes Selskabs Forhandlingar og dets Medlemmers Arbeider i Aaret 1866-67, Nos. 2-6; also 1867, Nos. 1-4. Volume for 1864. 1864-66. From the Society.*

Videnskabelige Meddelelser fra den Naturhistoriske Forening i Kjøbenhavn for Aaret 1865. Udgivne af selskabets Bestyrelse, 1866. From the Society.

NORWAY.

Christiania. Det Kongelige Norske Frederiks Universitets, Aarsberetning for Aaret 1864-65. From the University.

Forhandling i Videnskabs-selskabet i Christiania, Aars 1846-1863. From the Society.

RUSSIA.

Moscow. Bulletin de la Société Impériale des Naturalistes de Moscou. Année 1865, No. 3; 1866, Nos. 2, 3 and 4. From the Society.

Riga. Arbeiten des Naturforscher-Vereins zu Riga. Neue folge. 1es Heft. From the Society.

Correspondenzblatt des Naturforschenden Vereins zu Riga. 15er Jahrg. From the Society.

St. Petersburg. Horæ Societatis Entomologicæ Rossicæ variis sermonibus in Rossia usitatis editæ. Tome III., Nos. 1-4. Tome IV., Nos. 1-4. 1865-66. From the Society.

Bulletin de l'Académie Impériale des Sciences. Tomes X. and XI. From the Society.

Mémoires de l'Académie Impériale des Sciences. VII. Serie. Tome X., Nos. 1 to 16. Tome XI., Nos. 1-8. 1867. From the Society.

HOLLAND.

Amsterdam. Verslagen en Mededeelingen der k. Akademie van Wetenschappen, Afdeling Naturkunde Tweede Reeks Eerste und Negende Deel, 1866. From the Society.

Processen-Verbaal van de Gewone Vergaderingen der Koninklijke Akademie van Wetenschappen, 1867. From the Society.

Jaarboek van de k. Akademie van Wetenschappen voor 1865. From the Society.

Haarlem. Archives Néerlandaises des Sciences Exactes et Naturelles publiées par la Société Hollandaise des Sciences a Haarlem. Tome I., Livres 3 and 4; Tome II., Livres 1 and 2. From the Society.

Naturkundige Verhandelingen van de Hollandsche Maatschappij der Wetenschappen te Haarlem. Tweede Verzameling. 24er Deel, 1866. From the Society.

Hague. Archives Néerlandaises des Sciences Exactes et Naturelles publiées par la Société Hollandaise des Sciences a Haarlem. La Haye, 1866. Tome I., 1er and 2er Livr., 1866. From the Society.

Rotterdam. Nieuwe Verhandelingen van het Batâafsch Genootschap der Proefondervindelijke Wissbegeertete Rotterdam. Twaalfde Deel. 2 and 3 Stuk, 1865. From the Society.

Utrecht. Nederlandsch Meteorologisch Jaarboek voor 1866, uitgegeven door het Koninklijk Nederlandsch Meteorologisch Instituut. Eerste und Tweede Deel, 1866-67. From the Institute.

GERMANY.

Altenburg. Mittheilungen aus dem Osterlande, herausgegeben von der Naturforschenden Gesellschaft zu Altenburg. 17er Band, 3es and 4es Heft, 1866. From the Society.

Berlin. Zeitschrift der Deutschen geologischen Gesellschaft. 18 Band, 2, 3 and 4 Heft, 1866; 19 Band, 1 Heft, 1867. From the Society.

Archiv für Naturgeschichte, herausgegeben von Dr. F. H. Troschel. 31er Jahrg, 5es Heft; 32er Jahrg, 2-5 Heft, 33er Jahrg, 1es Heft, 1865-1867. From the Editor.

Monatsbericht der k. Preussischen Akademie der Wissenschaften. From Aug., 1866, to July, 1867. From the Society.

Berliner Entomologische Zeitschrift. Herausgegeben von dem Entomologischen Vereine in Berlin. Zehnter Jahrg., 1866, 4es Vierteljahrsheft, and 11er Jahrg., 1es and 2es Vierteljahrsheft. From the Society.

- Mathematische und Physikalische Abhandlungen der k. Akademie der Wissenschaften zu Berlin. Aus dem Jahre, 1865. From the Society.
- Wochenschrift des Vereines zur Beförderung des Gartenbaues in den K. P. Staaten für Gärtnerei und Pflanzenkunde. Nos. 1 to 52, for 1866; and Nos. 1 to 26, for 1867. From the Society.
- Zeitschrift für die gesammten Naturwissenschaften. Herausgegeben von dem Naturw. Vereine für Sachsen und Thüringen in Halle. Jahrgang 1866, 26, 27, 28 Band. From the Society.
- Bonn.** Verhandlungen des Naturhistorischen Vereines der preussischen Rheinlande und Westphalens. 23er Jahrg., 1es and 2es Heft. Bonn, 1866. With a geological map of the Prussian Rheinlands. From the Society.
- Braunschweig.** Archiv für Anthropologie, Zeitschrift für Naturgeschichte und Urgeschichte des Menschen. Erster Band, 2es Heft, und Zweiter Band, 1es, 2es und 3es Heft, 1867. From the Subscribers to the Library Fund.
- Bericht über die XIV. Versammlung der Deutschen Ornithologen-Gesellschaft im Waldkater zu Halberstadt und Braunschweig. From the Society.
- Bremen.** Abhandlungen der Naturwissenschaftlichen Vereine zu Bremen. 1 Band, 1 und 2 Hefes. From the Society.
- Jahres-Bericht des Schwedischen Heil-Gymnastischen Instituts in Bremen, 1866. From the Institute.
- Brünn.** Verhandlungen des Naturforschenden Vereines in Brünn. IV. Band, 1865, 1866. From the Society.
- Cassel.** Malakozologische Blätter. 13 Band, p. 145, to 14 Band, p. 144. From the Library Fund.
- Journal für Ornithologie. Herausgegeben von Dr. Jean Cabanis und Dr. Ed. Baldamus. From Heft. III., 14 Jahrg., to Heft. IV., 15 Jahrg. From the Wilson Fund.
- Danzig.** Schriften der Naturforschenden Gesellschaft in Danzig. Neue Folge. 1es Band, 3 und 4 Heft, 1866. From the Society.
- Dresden.** Sitzungsberichte der Naturwissenschaftlichen Gesellschaft Isis zu Dresden. Jahrg. 1866, Nos. 1—12. From the Society.
- Novorum Actorum Academiæ Cæsareæ Leopoldino-Carolinæ Germanicæ Naturæ Curiosorum. Tome 24, 1867. From the Society.
- Emden.** Einundfünfzig und Zweiundfünfzigster Jahresbericht der Naturforschenden Gesellschaft in Emden, 1865. Von Hermann Meier, 1866. From the Society.
- Festschrift der Naturforschenden Gesellschaft, for 1864. From the Society.
- Frankfurt-am-main.** Der Zoologische Garten, VII. Jahrg. 1866, Nos. 7—12, and VIII. Jahrg., 1867, Nos. 1—6. From the Editor.
- Jahresberichte über die Verwaltung des Medicinalwesens die Krankenanstalten. VII. Jahrg., 1863—1867. From the Society.
- Abhandlungen herausgegeben von der Senckenbergischen Naturforschenden Gesellschaft. 6es Band, 1 und 2es Heft., 1866. From the Society.
- Freiburg.** Berichte über die Verhandlungen der Naturforschenden Gesellschaft zu Freiburg I. B. 1867. From the Society.
- Giessen.** Zwölfter Bericht der Oberhessischen Gesellschaft für Natur- und Heilkunde, 1867. From the Society.
- Gotha.** Mittheilungen aus Justus Perthes Geographischer Anstalt, von Dr. A. Petermann. 1866, No. IX. to 1867, No. X. Ergänzungsheft, Nos. 19—21. From the Wilson Fund.
- Göttingen.** Nachrichten von der K. Gesellschaft der Wissenschaften und der Georg-Augusts-Universität aus dem Jahre 1866. From the Society.
- Halle.** Abhandlungen der Naturforschenden Gesellschaft zu Halle. 9er Band, 2es Heft; und 10er Band, 1es und 2es Heft. From the Society.

- Hamburg. Abhandlungen aus dem Gebiete der Naturwissenschaften herausgegeben von dem Naturwissenschaftlichen Verein in Hamburg. IV. Band, 4 Abth.; V. Band, 1 Abth., 1866. From the Society.
- Leipzig. Schriften der Gesellschaft zur Beförderung der gesammten Naturwissenschaften zu Marburg. Supplement Heft. Marburg, 1866. From the Society.
- Zeitschrift für Wissenschaftliche Zoologie. Herausgegeben von Carl T. v. Siebold und Albert Kölliker. 16er Band, 4es Heft; 17er Band, 1es-4es Heft. From the Wilson Fund.
- Archiv für Anatomie Physiologie und wissenschaftliche Medecin. Jahrg. 1866 Heft 4, to 1867 Heft 4. From the Subscribers to the Library Fund.
- Jenaische Zeitschrift für Medecin und Naturwissenschaft herausgegeben von der Medicinisch-Naturwissenschaftlichen Gesellschaft zu Jena. 3er Band, 1es, 2es und 3es Heft, 1867. From the Society.
- Berichte über die Verhandlungen der k. S. Gesellschaft der Wissenschaften zu Leipzig; Mathem. Physische Classe, 1865; 1866, I., II. und III. From the Society.
- Abhandlungen der Mathematisch-physischen Classe der k. Sächsischen Gesellschaft der Wissenschaften. VIII. Band, Nos. 2 and 3, 1866. From the Society.
- Preisschriften gekrönt und herausgegeben von der fürstlich Jablonowskischen Gessellschaft zu Leipzig. XIII., 1867. From the Society.
- Lüneburg. Jahreshefte des Naturwissenschaftlichen Vereins für das Fürstenthum Lüneburg. I.—X., 1865, and II., 1866. From the Society.
- Mannheim. Zweiunddreissigster Jahresbericht des Mannheimer Vereins für Naturkunde, 1866. From the Society.
- München. Sitzungsberichte der K. B. Akademie der Wissenschaften zu München. 1865, II., and 1866, I. From the Society.
- Abhandlungen der Philosophisch-Philol. Classe der K. B. Akademie der Wissenschaften. 10er Band, 3e Abth. Elfter Band, 1e Abth. Historischen Classe. 10er Band, 2e Abth. 1866. From the Society.
- Neubrandenburg. Archiv des Vereins der Freunde der Naturgeschichte in Mecklenburg. 26 Jahrg., 1866. From the Editors.
- Offenbach-am-Main. Siebenter Bericht des Offenbacher Vereins für Naturkunde über seine Thätigkeit vom 14 Mai 1865, bis zum 31 Mai 1866. From the Society.
- Prag. Sitzungsberichte der K. B. Gesellschaft der Wissenschaften in Prag. Jahrgang. 1865 und 1866. From the Society.
- Abhandlungen der K. B. Gesellschaft der Wissenschaften. 5e Folge, 4er Band. 1866.
- Regensburg. Flora oder allgemeine botanische Zeitung herausgegeben von der K. Bayer. botanischen Gesellschaft. Neue Reihe. 24 Jahrg., 1866. From the Society.
- Correspondenz-Blatt des zoologischen Mineralogischen Vereines in Regensburg. Zwanzigster Jahrgang, 1866. From the Society.
- St. Polten. Drittes Programm der Nö. Landes-Ober-Realschule in St. Polten, 1866. From the Society.
- Jahresbericht Turnvereins in St. Polten für das dritte Vereinsjahr 1865-6—1866. From the Society.
- Stuttgart. Württembergische Naturwissenschaftliche Jahreshefte. 21 und 22 Jahrgang; 23 Jahrg., 1es Heft. From the Society.
- Neues Jahrbuch für Mineralogie, Geologie und Paläontologie. Jahrg. 1865, 7es Heft, to 1867, 5es Heft. From the Editor.
- Vienna. Jahrbuch der K. K. geologischen Reichsanstalt. Jahrg. 1866, XVI. Band, Nos. 3 and 4; 1867, No. 1. From the Society.
- Sitzungsberichte der K. Akademie der Wissenschaften. Mathematisch-Naturwissenschaftliche Classe. From 1861 to 1867. Zweite Abtheilung, 9 Heft. From the Society.

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| Charles Lennig, a tract of land, from which \$2,000 have already been realized, estimated at..... | 2100 | H. C. Oram & Co | 500 |
| Joseph S. Lovering | 1000 | Joseph F. Page | 500 |
| Isaac Lea | 1000 | French, Richards & Co | 500 |
| J. B. Lippincott & Co | t. 1000 | Merrick & Sons | 500 |
| Elias D. Kennedy | 1000 | W. S. Stewart | 500 |
| H. P. McKean | 1000 | Thomas Smith | 500 |
| Wm. G. Moorhead | 1000 | Henry Seybert | 500 |
| Massey, Huston & Co | 1000 | Charles E. Smith | 500 |
| Wistar Morris | 1000 | Charles Taylor | 500 |
| Horstmann & Co | 1000 | J. Edgar Thomson | 500 |
| Thomas Potter | 1000 | Geo. F. Tyler | 500 |
| John Rice | 1000 | Samuel Welsh | 500 |
| Ed. Roberts | 1000 | Henry Winsor | 500 |
| S. J. Reeves | 1000 | J. A. Wright | 500 |
| Thomas Sparks | 1000 | Ed. S. Whelen | 500 |
| Thos. A. Scott | 1000 | Isaac S. Waterman | 500 |
| Geo. W. Tryon, Jr | 1000 | John Welsh | 500 |
| Morris, Tasker & Co | 1000 | Rockhill & Wilson | 500 |
| Wm. S. Vaux | 1000 | Robert Wood & Co | 500 |
| S. S. White | 1000 | Rich. D. Wood, a certificate for \$500 of Schuylkill Navigation Co., loan of 1882, valued at..... | 350 |
| W. P. Wilstach | 1000 | D. B. Cummins | 300 |
| S. Morris Waln | 1000 | C. P. Bayard | 250 |
| A. Whitney & Sons | 1000 | G. S. Benson | 250 |
| Wood, Morrell & Co | 1000 | J. E. Caldwell | 250 |

| | | | |
|-----------------------------------|-----|-------------------------------|-----|
| Ed. S. Clark..... | 250 | Henry B. Benners..... | 100 |
| Jos. W. Drexel..... | 250 | Joel J. Baily..... | 100 |
| Thomas Earp..... | 250 | Edw. C. Biddle..... | 100 |
| Frederic Graff..... | 250 | Eugene Borda..... | 100 |
| Frank Haseltine..... | 250 | David S. Brown..... | 100 |
| James C. Hand..... | 250 | A. Benson, Jr..... | 100 |
| B. Hammitt..... | 250 | F. L. Bodine..... | 100 |
| Wm. Hay..... | 250 | Bowen & Fox..... | 100 |
| E. C. Knight..... | 250 | Robert Carter..... | 100 |
| J. E. Kingsley..... | 250 | James Creighton..... | 100 |
| Jos. S. Lovering, Jr..... | 250 | Andrew C. Craig..... | 100 |
| Joseph Lea..... | 250 | Charles C. Cresson..... | 100 |
| Francis W. Lewis..... | 250 | Lemuel Coffin..... | 100 |
| John Livezey..... | 250 | C. Colket..... | 100 |
| Joshua Lippincott..... | 250 | Edmund Draper..... | 100 |
| Richard M. Marshall..... | 250 | Mark Devine..... | 100 |
| Israel Morris..... | 250 | Ferdinand J. Dreer..... | 100 |
| Samuel C. Morton..... | 250 | J. Coleman Drayton..... | 100 |
| Charles Magarge..... | 250 | Joseph H. Dulles..... | 100 |
| Horace Magee..... | 250 | Wm. Evans, Jr..... | 100 |
| Jas. Ronaldson Magee..... | 250 | Miss Elizabeth R. Fisher..... | 100 |
| C. F. Norton..... | 250 | A. L. Elwyn..... | 100 |
| Joseph Patterson..... | 250 | G. Emerson..... | 100 |
| Moro Phillips..... | 250 | Charles Ellis..... | 100 |
| Mrs. Eleanor P. Long..... | 250 | Saml. M. Fox..... | 100 |
| Lawrence S. Pepper..... | 250 | J. Edward Farnum..... | 100 |
| George S. Pepper..... | 250 | J. M. Foltz..... | 100 |
| Evan Randolph..... | 250 | C. H. Garden..... | 100 |
| Charles Spencer..... | 250 | Philip C. Garrett..... | 100 |
| P. W. Sheaffer..... | 250 | Constant Guillou..... | 100 |
| John T. Taitt..... | 250 | L. A. Godey..... | 100 |
| John B. Trevor..... | 250 | Daniel Haddock, Jr..... | 100 |
| George Vaux..... | 250 | Harry C. Hart..... | 100 |
| Mrs E. H. Vaux..... | 250 | Wm. H. Hart..... | 100 |
| Wm. Welsh..... | 250 | C. J. Hoffman..... | 100 |
| Morris Wheeler & Co..... | 250 | F. A. Hoyt & Bro..... | 100 |
| Charles Wheeler..... | 250 | E. M. Hopkins..... | 100 |
| A. Whilldin..... | 250 | Pemberton S. Hutchinson..... | 100 |
| Wm. R. White, Jr..... | 250 | George Harding..... | 100 |
| Joseph Wharton..... | 250 | E. L. Handy..... | 100 |
| Benjamin Bullock..... | 200 | B. A. Hoopes..... | 100 |
| Atherton Blight..... | 200 | John Haseltine..... | 100 |
| Cash, per Dr. Chas. Shaeffer..... | 200 | C. H. Hutchinson..... | 100 |
| John C. Davis..... | 200 | A. A. Henderson..... | 100 |
| Charles Humphreys..... | 200 | Huneker & Brant..... | 100 |
| R. Peterson..... | 200 | John Jordan, Jr..... | 100 |
| J. D. Rosengarten..... | 200 | W. P. Jenks..... | 100 |
| Benj. H. Shoemaker..... | 200 | John Krider..... | 100 |
| Robert Shoemaker..... | 200 | John Lambert..... | 100 |
| David Stuart..... | 200 | Joseph Leidy..... | 100 |
| C. B. Wright..... | 200 | Chas. S. Lewis..... | 100 |
| Chas. J. Allen..... | 100 | George T. Lewis..... | 100 |
| Joseph B. Altemus..... | 100 | John T. Lewis..... | 100 |
| Abr. Barker..... | 100 | J. L. Le Conte..... | 100 |
| Ch. S. Boker..... | 100 | Amos R. Little..... | 100 |
| S. B. Barcroft..... | 100 | W. R. Lejee..... | 100 |
| Alexander Benson..... | 100 | J. Dickinson Logan..... | 100 |
| Charles N. Bancker..... | 100 | A. Sidney Logan..... | 100 |
| John J. Borie..... | 100 | Benj. V. Marsh..... | 100 |

| | | | |
|---------------------------|-----|---------------------------------|-----------|
| John McAllister, Jr | 100 | Wm. S. Wilson..... | 100 |
| Joseph Wm. Miller..... | 100 | Ellwood Wilson..... | 100 |
| J. B. Myers..... | 100 | Joseph Walton..... | 100 |
| Nathan Myers..... | 100 | Mrs. C. S. Wurts..... | 100 |
| Jos. B. Myers..... | 100 | Richard Wood..... | 100 |
| Wm. L. Mactier..... | 100 | John Welsh, Jr..... | 100 |
| Isaac P. Morris..... | 100 | Mifflin Wistar..... | 100 |
| Matthews & Moore..... | 100 | Ellis Yarnall..... | 100 |
| Wm. Musser..... | 100 | James T. Young..... | 100 |
| John B. Mellor..... | 100 | Sundry small subscriptions..... | 128 |
| Wm. Mellor..... | 100 | Moses Brown..... | 50 |
| G. H. Newhall..... | 100 | H. Bumm..... | 50 |
| Charles Norris..... | 100 | Jos. A. Clay..... | 50 |
| Wm. F. Norris..... | 100 | Charles Cabot..... | 50 |
| G. W. Norris..... | 100 | George Cromelien..... | 50 |
| John S. Newbold..... | 100 | E. Durand..... | 50 |
| Robert E. Peterson..... | 100 | R. D..... | 50 |
| G. F. Peabody..... | 100 | John W. Field..... | 50 |
| John B. Parker..... | 100 | R. Guillou..... | 50 |
| Samuel Powel..... | 100 | James Harper..... | 50 |
| Charles W. Poultney..... | 100 | Isaac Hays..... | 50 |
| J. S. Phillips..... | 100 | E. H..... | 50 |
| Philip Physick Peace..... | 100 | J. H. Hutchinson..... | 50 |
| E. Coleman Peace..... | 100 | O. A. Judson..... | 50 |
| James W. Queen..... | 100 | H. C. Kennedy..... | 50 |
| R. E. Rogers..... | 100 | Chs. M. Leisenring..... | 50 |
| Richard Richardson..... | 100 | Levi Morris..... | 50 |
| Wm. Rowland & Co..... | 100 | Wm. V. McKean..... | 50 |
| Evans Rogers..... | 100 | Merrihew & Son..... | 50 |
| C. H. Rogers..... | 100 | Chs. Norris, Jr..... | 50 |
| Solomon W. Roberts..... | 100 | Benj. Orne..... | 50 |
| Josiah Reigel..... | 100 | P. S. Peterson..... | 50 |
| Samuel R. Shipley..... | 100 | C. J. Price..... | 50 |
| Charles Santee..... | 100 | E. F. Rivinus..... | 50 |
| Louis Starr..... | 100 | E. L. Reakirt..... | 50 |
| Daniel Smith, Jr..... | 100 | John Turner..... | 50 |
| Ed. A. Souder & Co..... | 100 | J. B. Vandusen..... | 50 |
| Jos. Scattergood..... | 100 | Chs. S. Wurts..... | 50 |
| Geo. J. Scattergood..... | 100 | Alexander Wilcocks..... | 50 |
| Wm. Struthers..... | 100 | F. L. Williams..... | 50 |
| Charles L. Sharpless..... | 100 | Wm. P. Bancroft..... | 25 |
| Wm. H. Sowers..... | 100 | Chs. M. Ghriskey..... | 25 |
| Aubrey H. Smith..... | 100 | Louis A. Godey..... | 25 |
| J. Rinaldo Sank..... | 100 | J. R. Goodman..... | 25 |
| J. H. Slack..... | 100 | John O. James..... | 25 |
| W. L. Schaffer..... | 100 | Geo. S. Jones..... | 25 |
| Charles Smith..... | 100 | S. Weir Mitchell..... | 25 |
| John Supplee..... | 100 | Thomas Meehan..... | 25 |
| J. D. Sergeant..... | 100 | E. M. Needles..... | 25 |
| Joseph P. Smith..... | 100 | John Pearsall..... | 25 |
| James Spea..... | 100 | C. F. Parker..... | 25 |
| W. P. Tatham..... | 100 | Wm. W. Paul..... | 25 |
| Samuel B. Thomas..... | 100 | Geo. A. Smith..... | 25 |
| B. T. Tredick..... | 100 | T. Guilford Smith..... | 25 |
| Wm. P. Turnbull..... | 100 | D. L. Woods..... | 25 |
| Wm. G. Thomas..... | 100 | | |
| Alfred Vezin..... | 100 | Total..... | \$108,803 |
| Henry A. Vezin..... | 100 | Aggregate of subscriptions paid | |
| H. M. Watts..... | 100 | up to Decem. 31 | \$93,803 |

MEMBERS

OF THE

ACADEMY OF NATURAL SCIENCES

OF

PHILADELPHIA,

From the origin of the Society to January 1st, 1868.

Names of members known to be deceased are in *italics*. Names of life members are preceded by an asterisk (*). Names of members who are not residents of the city are followed by the letters (N.R.) Names of those who were originally elected correspondents, and became members by removal to the city, are followed by (corres.) The names of those who have resigned, or who have forfeited membership, are not included. Correspondents are regarded as members when they become permanent residents in the city.

Wm. S., M.D., Dec. 1812.
Wm. Thomas, Jan. 1813.
Col. J. J. (N.R.), Oct. 1828.
Charles Henry, June, 1837.
Ad. Samuel, Sept. 1839.
Nathan, M.D., May, 1841.
Ad. Samuel B., Jan. 1843.
Wm. H., Aug. 1851.
F. M., M.D., April, 1852.
Erst, Lewis R., May, 1853.
Wm. G. E. (N.R.), May, 1853.
Walter F., M.D., May, 1857.
Erst, Lewis, Feb. 1859.
Erst, John, M.D., Oct. 1860.
Erst, Wm. H., Feb. 1861.
Harrison, M.D., July, 1862.
Erst, John B., Jan. 1867.
Erst, Samuel, M. D., March, 1867.
Erst, Francis, M. D., March, 1867.
Erst, A. J., Dec. 1867.
Erst, John, M.D. (N.R.), April, 1812.
Erst, Edward, M.D., Aug. 1815.
Erst, Moses, Feb. 1817.

**Biddle*, Nicholas, Jan. 1818.
**Brewer*, John M. (corres.), Oct. 1820.
Bowen, George T., Nov. 1822.
Birch, Wm. Y., Dec. 1823.
Bonaparte, Charles L. (N.R.), Feb. 1824.
**Bancker*, Charles N., April, 1824.
**Beck*, Charles F., M.D., June, 1827.
Bache, Alex. Dallas (N.R.), Jan. 1829.
Bond, Henry, M.D., Jan. 1830.
**Burrough*, Marmaduke, M.D., Nov. 1830.
**Bridges*, Robert, M.D., Jan. 1835.
Bowie, Thomas L., Dec. 1835.
Browne, Peter A., May, 1841.
**Baird*, S. F. (N.R.) (corres.), Aug. 1842.
**Biddle*, Alexander, Aug. 1848.
Barton, T. Pennant (N.R.), April, 1849.
Belknap, Henry (N.R.), May, 1849.
**Biddle*, Clement, May, 1850.
Brinton, John H., M.D., June, 1851.
**Budd*, Chas. H., M.D. (N.R.), Mar. 1852.
Boller, Henry J., April, 1852.
Buckley, Ed. S., May, 1852.
**Biddle*, Henry J., Aug. 1852.
Booth, James C., Sept. 1852.

- *Biddle, Thomas, May, 1853.
 *Brown, John A., May, 1853.
 *Brown, David S., May, 1853.
 *Brown, Joseph D., May, 1853.
 Bullitt, John C., July, 1853.
 Borda, Eugene, Sept. 1854.
 *Barton, Isaac, March, 1855.
 *Barcroft, Stacy B., July, 1855.
 Brower, Robt. F., M.D. (N.R.), Nov. 1855.
 *Brasier, Amable J., March, 1856.
 Boker, Chas. S., M.D., June, 1856.
 Binney, W. G., Sept. 1856.
 Bertholet, P. P., M.D. (N.R.), Mar. 1857.
 Bennett, Daniel R. (N.R.), Feb. 1858.
 *Brown, Joseph Johnson, March, 1853.
 Breed, Rev. Wm. P., June, 1858.
 *Blight, Atherton, July, 1858.
 Butler, Pierce, Aug. 1858.
 *Bohlen, John, Feb. 1859.
 *Biddle, Thos. A., March, 1859.
 *Budd, John B., June, 1859.
 Bell, John G. (N.R.), May, 1860.
 Bolling, Robt., M.D., Nov. 1860.
 *Bucknell, Wm., March, 1861.
 Brown, A. D. (N.R.), Nov. 1861.
 Billings, John S., M.D., Nov. 1862.
 Briggs, Robert, Jan. 1864.
 Bonsall, Chas. F., Nov. 1864.
 Bryant Henry, M.D. (N.R.), May, 1865.
 *Browning, Edward, June, 1865.
 Barnard, Vincent, Sept. 1865.
 Bready, John E., Sept. 1865.
 *Burk, Isaac, Dec. 1865.
 Beadle, Rev. E. R., Jan. 1866.
 Bland, Jas. H. B., Jan. 1866.
 Boardman, Rev. Geo. D., April, 1866.
 Butcher, Henry B., M.D., June, 1866.
 *Baird, Wm. S., Jan. 1867.
 Bodine, F. L., Feb. 1867.
 *Borie, Charles H., Feb. 1867.
 Bellows, Horace M., M.D., Feb. 1867.
 Beman, Rev. I. L., March, 1867.
 *Bohlen, Miss, March, 1867.
 *Borie, Beauveau, April, 1867.
 *Borie, Adolph E., April, 1867.
 *Baird, Matthew, April, 1867.
 *Benson, Gustavus S., April, 1867.
 *Blanchard, Wm. A., April, 1867.
 *Beach, O. Nichols, May, 1867.
 Bement, Clarence S., May, 1867.
 *Bayard, C. P., May, 1867.
 *Baird, John, May, 1867.
 *Betts, Richard K., Dec. 1867.
 Brown, Geo. W., M.D., Dec. 1867.
 Correa de Serra, Joseph, Feb. 1814.
 Coze, Alexander S., Feb. 1815.
 *Collins, Zaccheus, March, 1815.
 Cleaver, Isaac, M.D., Jan. 1817.
 *Clark, Edward (N.R.), Jan. 1817.
 *Carmalt, Caleb (N.R.), Aug. 1817.
 *Coates, Benj. H., M.D., April, 1818.
 *Carpenter, Geo. W., July, 1825.
 *Clark, John Y., M.D., Feb. 1826.
 *Conrad, Solomon W., March, 1826.
 Conrad, Timothy A., Jan. 1831.
 Carson, Joseph, M.D., Oct. 1833.
 Chase, Heber, M.D., Aug. 1836.
 *Clay, Joseph A., Aug. 1837.
 Camac, Wm. M., March, 1839.
 *Cresson, Chas. C., Sept. 1840.
 *Cassin, John, Sept. 1842.
 Curtis, Josiah (N.R.), June, 1843.
 Cuesta, Fernando de la (N.R.), Nov. 1844.
 Clemm, Charles (N.R.), Oct. 1847.
 *Cope, Caleb, Jan. 1848.
 *Cooke, John, Jan. 1848.
 Caldcleugh, Robert A., Nov. 1851.
 *Camac, Wm., M.D., April, 1852.
 *Claghorn, James L., July, 1852.
 *Collet, Mark W., M.D., Sept. 1852.
 Corse, James M., M.D., Nov. 1852.
 *Cresson, John C., April, 1853.
 Collins, Percival, Sept. 1853.
 Cadwalader, Wm., March, 1855.
 Clements, Richard, M.D., July, 1855.
 Cresson, Chas. M., M.D., March, 1856.
 *Cope, Alfred, July, 1856.
 Cleburne, Wm. (N.R.) March 31, 1857.
 Carter, Robt., M.D., April, 1857.
 *Cummins, Daniel B., June, 1857.
 Caldwell, H. Clay, M.D., Nov. 1857.
 Cuthbert, Mayland, Dec. 1857.
 Covey, Edward N., M.D. (N.R.), Dec. 1857.
 Clarke, Edw. S., Jan. 1858.
 Cresson, Ezra T., April, 1858.

- Coleman, Geo. Dawson (N.R.), Apr. 1858. *Dundas, Jas.*, Aug. 1844.
 Clark, T. Edwards (N.R.), Dec. 1859. *Dickeson, M. W., M.D., Oct. 1846.
 *Clark, J. Hinckley, March, 1859. *Da Costa, J. C., M.D., Feb. 1852.
 *Cox, James S., June, 1859. *Ducachet, Rev. H. W.*, D.D., April, 1852.
 Cram, Capt. T. J. (N.R.) Oct. 1859. Durand, Elias, April, 1852.
 Cox, Brinton, Dec. 1859. *Dunglison, Robley, M.D., Jan. 1853.
 Comly, Franklin A., Feb. 1860. *Draper, Edmund, May, 1853.
 Coates, Andrew (N.R.), May, 1860. Dock, Geo., M.D. (N.R.), Feb. 1854.
 Cregar, Philip A., June, 1860. *Dunlap, Thos.*, Dec. 1856.
 Cleborne, Chris. J., M.D., July, 1860. *Dreer, Ferdinand J., April, 1857.
 *Carpenter, Geo. W. Jr., Oct. 1860. Da Costa, John C., Sr., June, 1857.
 Carbonell, Felix B. (N.R.), Dec. 1860. Da Costa, John C., Jr., June, 1857.
 *Canby, Wm. M. (N.R.), Feb. 1861. *Drayton, Henry E.*, M.D., April, 1858.
 Conrad, Thomas K. (N.R.) Feb. 1861. *Dimpfel, F. P., April, 1858.
 *Conarroe, Geo. M., Feb. 1861. *Davidson, Geo., Aug. 1858.
 *Cope, Edward D., July, 1861. Dow, John M. (N.R.), Sept. 1858.
 *Crozer, John P., March, 1862. Da Costa, Geo. J., Oct. 1858.
 Curtis, Edw., M.D., July, 1863. Darrach, Jas. A., M.D., Nov. 1858.
 Coxe, Eckley, Jan. 1865. Darby, John T., M.D. (N.R.), March, 1859.
 Childs, Geo. W., Jan. 1866. Davis, John C., June, 1859.
 Carpenter, L. Henry, Major, June, 1866. Downie, T. C. (N.R.), Aug. 1859.
 Crawford, S. Wylie, Gen., M.D., Aug. 1866. *Drexel, Jos. W., June, 1860.
 Calhoun, Maj. A. R., Dec. 1866. *Dieffenbaugh, E., Dec., 1865.
 *Cope, Francis R., Feb. 1867. De Figniere, Alfonso (N.R.), Mar. 1866.
 *Cope, Thomas P., Feb., 1867. Durborow, Chas. B., March, 1866.
 *Cope, Miss R. A., Feb. 1867. Deal, Lemuel J., M.D., April, 1866.
 *Carpenter, Samuel P., Feb. 1867. Dreer, Henry A., May, 1866.
 *Colwell, Stephen, Feb. 1867. Dixon, W. C., M.D., Oct. 1866.
 *Cooper, Lewis, March, 1867. Davids, Hugh, Dec. 1866.
 Comegys, Benj. B., March, 1867. *Eberle, John*, M.D., April, 1819.
 *Coxe, Charles S., April, 1867. *Ellmaker, Levi, April, 1829.
 *Campbell, A., April, 1867. Elwyn, Alfred L., M.D., Dec., 1831.
 *Clark, E. W., May, 1867. Evans, Edm. C., M.D. (N.R.), Oct. 1838.
 *Clark, Clarence H., May, 1867. *Ellet, Chas., Jr., April, 1842.
 *Clark, Frank H., May, 1867. *Edwards, Amory (N.R.), March, 1852.
 *Crease, Orlando, May, 1867. Emerson, G., M.D., Aug. 1853.
 *Cheston, D. Murray, M.D., May, 1867. Ennis, Jacob, Feb. 1857.
 *Clyde, Thomas, May, 1867. Eastwick, Edward P. (N.R.), May, 1857.
 *Cooke, Jay, May, 1867. Edwards, Arthur M. (N.R.), Sept. 1858.
 *Dobson, Judah, Nov. 1813. Egbert, Daniel, M.D. (N.R.), Oct. 1858.
 Davis, David Jones, June, 1815. Emlen, J. Norris, April, 1859.
 *Dulles, Joseph H., Feb. 1816. Elliot, D. G. (N.R.), May, 1860.
 *Deitz, Rudolph, Jan. 1821. *Evans, Rowland E.*, Nov. 1860.
 Dunn, Nathan (corres.), June, 1828. Evans, Wm., Jr., Feb. 1866.
 Davis, Chas., M.D. (N.R.), March, 1842. Edwards, Edward B., Jan. 1867.
 Dickson, S. Henry, M.D., (cor.), Feb. 1843. *Earp, Thomas, March, 1867.
 Darrach, Wm., M.D., May, 1844.

- Frazer, Robert*, April, 1814.
 **Fisher, Joseph*, May, 1821.
Fisher, Thomas, April, 1824.
Foster, Wm. A., Nov. 1833.
Foster, Hudson S., Jan. 1834.
Frazer, John F., Sept. 1835.
French, Benj. F. (corres.), Jan. 1843.
 **Frost, John*, Sept. 1844.
Foulke, Wm. Parker, Nov. 1849.
 **Fisher, Jas. C.*, M.D. (N.R.), July, 1850.
 **Fahnestock, Geo. W.*, Aug. 1852.
 **Fisher, Charles Henry*, May, 1853.
 **Farnum, John*, May, 1853.
 **Fisher, J. Francis*, May, 1853.
 **Fell, J. G.*, May, 1853.
Forbes, W. S., M.D., Sept. 1856.
Francfort, Eug., M.D. (N.R.), Oct. 1856.
Fassitt, Louis, M.D., Jan. 1857.
Fry, J. Reese, Jan. 1857.
Fryer, Blancour E., April, 1858.
Foltz, Jonathan, M.D., May, 1859.
Field, Thos. Y., Aug. 1859.
Frampton, L. A., M.D., (N.R.), Sept. 1859.
Fricke, Albert, M.D., Nov. 1859.
Feltus, Henry J., Nov. 1859.
Fry, Horace B., Dec. 1859.
Felton, Samuel M. (N.R.), Feb. 1860.
Foard, A. J., M.D., Dec. 1860.
Furness, H. H., Nov. 1861.
Fiot, Augustus, Jan. 1864.
Frazer, Robert, Jan. 1866.
Febiger, Christian C., May, 1866.
Fenimore, Jason L., June, 1866.
Ford, John, Dec. 1866.
Farnum, J. Edwards, Jan., 1867.
 **Gilliams, Jacob* M.D. (found.), Jan. 1812.
Griffith, R. Eggesfield, M.D., May, 1815.
Godman, John D., M.D., July, 1821.
Goddard, Paul B., M.D., Feb. 1829.
Griscom, Samuel S., Nov. 1830.
Gibbons, Wm. P. (N.R.), Nov. 1833.
Gumbes, Sam. Wetherill, April, 1834.
 **Gerhard, Wm. W.*, M.D., Nov. 1835.
Gambel, Wm., M.D., Aug. 1843.
Germain, Lewis J. (N.R.), April, 1846.
Goddard, Kingston, Rev. (N.R.), Jan. 1848.
Grant, Wm. Robertson, M.D., Dec. 1849.
Genth, Fred. A., M.D., April, 1852.
 **Greene, Francis V.*, M.D. (N.R.) Sept. 1853.
 **Griffith, Robert E.*, Sept. 1852.
 **Graff, Frederic*, May, 1853.
 **Grigg, John*, May, 1853.
Guillou, Constant, March, 1854.
Geyelin, Emile, Sept. 1854.
 **Guez, John A.*, Nov. 1854.
Gibbs, George (N.R.), Jan. 1856.
Garrigues, S. S., M.D. (N.R.) June, 1856.
Gobrecht, W. H. (N.R.), M.D., July, 1856.
Griffith, Robt. E., M.D., Oct. 1856.
Gross, Saml. D., M.D., Dec. 1856.
Gorgas, Albert C., M.D., Feb. 1857.
Guillou, Victor, Oct. 1859.
Grier, Wm. P., M.D., June, 1859.
Greenbank, Richard M., M.D., Oct. 1859.
Gabb, Wm. M. (N.R.), Jan. 1860.
Grubb, Edw. Burd (N.R.), April, 1860.
Goodman, J. R., M.D., March, 1864.
 **Grant, Gen. Ulysses S.*, July, 1865.
 **Graeff, John E.*, Feb. 1866.
 **Garrett, Philip C.*, Feb. 1866.
Gilbert, Wm. K., M.D., May, 1866.
Guier, Geo. M.D. (N.R.), June, 1866.
 **Grant, Wm. S.*, Dec. 1866.
Gibbons, Charles, Jan., 1867.
 **Greble, Edwin*, Jan., 1867.
 **Gratz, Robert H.*, April, 1867.
 **Gibson, Henry C.*, July, 1867.
 **Gibson, John*, July, 1867.
 **Haines, Reuben*, Nov. 1813.
 **Hare, Robert*, M.D., Nov. 1813.
Hazard, Saml. (corres.), Jan. 1814.
 **Harlan, Richard*, M.D., Oct. 1815.
 **Hays, Isaac*, M.D., July, 1818.
Hentz, N. M. (N.R.), May, 1819.
 **Hembel, William*, Sept. 1824.
 **Hering, C.*, M.D., (corres.), Oct. 1826.
Horsfield, S. C. C. (N.R.), Oct. 1830.
Huffnagle, Chas., M.D. (N.R.), Nov. 1830.
 **Hallowell, Edw.*, M.D., Feb. 1834.
 **Harris, Edward* (N.R.), Aug. 1835.
 **Haldeman, S. S.* (N.R.), Jan. 1837.
 **Holmes, Chas.*, Feb. 1838.
 **Haines, John S.*, March, 1841.
Heister, J. P., M.D. (N.R.), Nov. 1843.

- Heermann, Adolphus L.*, M.D., April, 1845. *Haseltine, C. F.*, Jan., 1867.
Hartshorne, Edw., M.D., May, 1847. *Hacker, Wm.*, Feb. 1867.
 **Haines, Robt. B.*, Jan. 1848. **Haines, Miss Ann*, Feb. 1867.
Henderson, A.A., M.D. (corres.) July, 1848. **Haines, Miss Jane R.*, Feb. 1867.
 **Horner, Wm. E.*, M.D., Feb. 1849. *Heger, Anthony*, M.D., Feb. 1867
Henry, Bernard, M.D., May, 1849. **Hay, William*, April, 1867.
Hopkinson, Joseph, M.D., Feb. 1852. **Houston, H. H.*, April, 1867.
 **Hewson, Addinell*, M.D., Jan. 1853. **Haseltine, Frank*, May, 1867.
Hanson, H. Cooper, Feb. 1853. **Hammitt, B.*, June, 1867.
 **Hallowell, Morris L.* (N.R.), May, 1853. *Hare, H. Binney*, M.D., Aug. 1867.
 **Hutchinson, J. Pemberton*, May, 1853. *Hinkle, A. G.*, M.D., Sept. 1867.
Harrison, Joseph, Jr., Aug. 1854. *Hassler, F. A. M.D.*, Nov. 1867.
Tilgard, Theo. C., M.D. (N.R.), Oct. 1854.
Hooper, Wm. H., M.D., Dec. 1854. *Jones, Thos. P.*, M.D., Dec. 1812.
Hunt, Wm., M.D., Jan. 1855. **James, Thos. C.*, M.D., March, 1814.
Hartshorne, Henry, M.D., April, 1855. **Jessup, Augustus E.*, Nov. 1818.
Hagedorn, C. F., Aug. 1855. *Johnson, Walter R.* (N.R.), Feb. 1827.
 **Humphreys, Geo. A.*, Sept. 1855. **Jaudon, Samuel* (N.R.), Jan. 1836.
Hering, C. J. (N.R.), Sept. 1855. *Jackson, Isaac R.*, Aug. 1841.
Howell, Saml. B., M.D., Nov. 1855. **Jordan, John, Jr.*, Jan. 1851.
 **Hayes, Isaac I.*, M.D., Jan. 1856. **Jeanes, Joseph*, May, 1853.
 **Hoopes, B. A.*, Feb. 1856. **Jeanes, Samuel*, Jan. 1856.
Hayden, F. V., M.D. (corres.), Mar. 1856. **Jessup, Edw. A.*, Nov. 1857.
Halsey, Wm. S., M.D., April, 1857. *Janeway, John H.*, M.D. (N.R.) Sept. 1858.
Haldeman, Rich. J. (N.R.), Aug. 1857. *Judson, Oliver A.*, M.D., Oct. 1858.
Harlow, Louis D., M.D., Aug. 1857. *Johnson, Christopher* (N.R.), Dec. 1858.
Hoyt, Wm. D., M.D., Feb. 1858. *Johnston, Alex.*, March, 1860.
Hart, Harry C., M.D., March, 1858. *Jenks, Wm. Furness* (N.R.), Oct. 1863.
 **Hutchinson, Jas. H.*, M.D., April, 1858. *Jones, Wm. Forster*, Jan. 1866.
Huntington, David L., M.D., April, 1858. *Jayne, Eben C.*, Dec. 1866.
 **Hunt, J. Gibbons*, M.D., July, 1858. **Jeanes, Joshua T.*, Dec. 1866.
 **Henszey, W. C.*, Jan. 1859. *Jenkins, Wilson M.*, Jan. 1867.
Hare, Robt. H., Feb. 1859.
 **Haseltine, John*, April, 1859.
 **Haseltine, Ward B.*, April, 1859.
Horner, Alfred, June, 1859.
 **Hand, James C.*, July, 1860.
Hepburn, Jas. (N.R.), June, 1863.
 **Horstmann, Wm. J.*, Dec. 1863.
Hugel, A., Sept. 1865.
 **Hartshorne, Chas.*, Feb. 1866.
Hunt, Clemmons, March, 1866.
Hoopes, Josiah (N.R.), April, 1866.
 **Haddock, Daniel, Jr.*, May, 1866.
 **Huston, Samuel*, May, 1866.
Horn, Geo. H., M.D., July, 1866.
Houston, Edwin J., Dec. 1866.

- **Kneass, Wm.*, May, 1814.
 **Keating, Wm. H.*, April, 1816.
Keagy, J. M., M.D., Jan. 1843.
Kane, Elisha K., Jan. 1843.
 **Kilvington, Robert*, April, 1843.
King, Chas. R., M.D., June, 1843.
Kern, Richard H., May, 1847.
Kern, Benj. J., M.D., Sept. 1847.
Kern, Edward M. (N.R.), Oct. 1847.
Keller, Wilhelm, M.D., Nov. 1848.
Keim, Geo. M. (N.R.), July, 1852.
 **Keating, Wm. V.*, M.D., Jan. 1853.
Kennicott, Robt. (corres., N.R.), April, 1858.
Kimber, Thos., Jr., April, 1858.

- Kneeland, Saml., Jr., M.D., May, 1858.
 Kitchen, John S., M.D., June, 1858.
 Krider, John, March, 1859.
 Kane, John E., M.D. (N.R.), April, 1859.
 Kendall, Prof. E. Otis, March, 1860.
 Kingsbury, Chas. A., M.D., March, 1860.
 Knight, J. Frank, Feb. 1863.
 King, Wm. S., M.D., July, 1863.
 King, Wm. M., M.D., Oct. 1863.
 Keffer, Fred. A., M.D., Nov. 1864.
 Kinsman, Chas. W., Feb. 1865.
 *Klett, Frederick, Dec. 1865.
 *Keehmle, Wm. C., March, 1866.
 Kenderdine, Robt. S., M.D., May, 1866.
 Keen, Wm., Jr., M.D., April, 1867.
 *Knight, Edw. C., May, 1867.
 *Kennedy, Elias D., Aug. 1867.

 *Lukens, Isaiah, June, 1812.
Le Conte, John (corres.), Feb. 1815.
Lea, John, May, 1815.
 *Lea, Isaac, LL.D., June, 1815.
 Longstreth, Joshua, June, 1815.
 *Lesueur, Chs. A., Jan. 1818.
Land, John (N.R.), May, 1836.
 *Le Conte, J. L., M.D. (corres.) Feb. 1845.
 *Leidy, Joseph, M.D., July, 1845.
 *Lewis, Elisha J., M.D., July, 1846.
 *Lambert, John, Nov. 1846.
 *Lea, M. Carey, Sept. 1847.
 *Lennig, Chas., Oct. 1847.
 *Ludlow, John L., M.D., Nov. 1847.
 Lejée, Wm. R., Feb. 1848.
 *Lea, H. C., Feb. 1848.
 *Lewis, Francis W., M.D., Oct. 1849.
 *Lennig, Francis, July, 1851.
 Langstroth, Rev. L. L. (N.R.), Sept. 1851.
 *Lea, Joseph, June, 1852.
 *Logan, J. Dickinson, M.D., Mar. 1853.
Lang, Edmund, M.D., April, 1853.
 *Lea, Thos. T., May, 1853.
 *Lewis, A. J., May, 1853.
 *Lovering, Joseph S., May, 1853.
 Lippincott, Joshua B., June, 1853.
 Lesley, J. P., June, 1853.
 Luther, Diller, M.D. (N.R.), Oct. 1854.
 La Roche, C. Percy, M.D., Oct. 1855.
 Lewis, Samuel, M.D., Oct. 1855.
 Lamborn, R. H., May, 1857.
 Lowber, Wm., M.D., June, 1858.
 Letterman, Jon. C., M.D. (N.R.), Jan. 1859.
 Littell, Emlen T., Jan. 1859.
 Lesley, Joseph, Jr., March, 1859.
 *Lewis, Saunders, March, 1859.
 Lippincott, Joshua, April, 1859.
 *Longstreth, Wm. W., Feb. 1860.
 Lewis, Joseph S., Jan. 1861.
 Leyppoldt, F. (N.R.), March, 1862.
 Lorenz, W. (N.R.), Feb. 1863.
 *Lewis, Geo. T., Dec. 1863.
 Lyman, Benj. Smith, Aug. 1865.
 *Little, Amos R., March, 1866.
 *Lewis, Chas. S., April, 1866.
 Leeds, Albert R., Dec. 1866.
 Levick, James, M.D., Jan. 1867.
 *Lovering, Jos. S. Jr., Feb. 1867.
 *Livezey, John, Feb. 1867.
 *Long, Mrs. E. P., March, 1867.
 *Little, James H., April, 1867.
 Langdon, T. Brantley, July, 1867.
 Leeds, Josiah W., Dec. 1867.

 *Mann, C. M. (founder), Jan. 1812.
 *Maclure, Wm., July, 1812.
 *M'Euen, Thos., M.D., May, 1818.
 *Morton, Saml. Geo., M.D., April, 1820.
 *Mitchell, John K., M.D., July, 1822.
 Mickle, Andrew E., M.D., June, 1831.
 Mütter, Thos. D., M.D., July, 1833.
 M'Euen, Chas., Dec. 1834.
 Mifflin, Geo., March, 1835.
 Miller, Clement S., Dec. 1836.
 *Markland, John H., May, 1839.
 *Maclure, Alexander, Dec. 1840.
 Moss, Theo. F., June, 1845.
 M'Call, Gen. G. A. (corres.), June, 1847.
 M'Clellan, J. H. B., M.D., Nov. 1847.
 M'Michael, Wm., June, 1850.
 *Meigs, J. Forsyth, M.D., April, 1852.
 *Morris, Jacob G., April, 1852.
 *Meigs, Jas. Aitken, M.D., April, 1852.
 *Mercer, Singleton A., May, 1853.
 *Merrick, Saml. V., May, 1853.
 *Myers, John B., May, 1853.

- Mitchell, S. Weir, M.D., Sept. 1853.
 Merrick, J. Vaughan, April, 1854.
 Messchert, M. H., June, 1854.
 *Morris, J. Cheston, M.D., Oct. 1854.
 *Moore, Saml., M.D., Nov. 1855.
 M'Allister, John, Jr., June, 1856.
 Monnier, Alfred (N.R.), Aug. 1856.
 Morton, Thos. Geo., M.D., Aug. 1856.
 Morehouse, Geo. R., M.D., Aug. 1856.
 Marsh, Benj. V., April, 1857.
 McGuire, Jas. C. (N.R.), April, 1857.
 *Martin, Geo., M.D., April, 1857.
 Minturn, Edw., M.D., Oct. 1857.
 McClune, Jas., Jan. 1858.
 McAllister, Wm. Y., Feb. 1858.
 McEuen, Chas. Izard, June, 1858.
 McCaules, John, April, 1859.
 Maguire, Nicholas H., July, 1859.
 *Morris, Miss Margaretta H., Sept. 1859.
 *Mactier, Wm. L., Jan. 1860.
 *Meehan, Thos., March, 1860.
 Moore, Francis, M.D., May, 1860.
 *Mordecai, Edw. R., M.D. (N.R.) May, 1860.
 Mitchell, Edw. Craig (N.R.), July, 1860.
 *Morris, Henry, March, 1862.
 Miller, E. Spencer, May, 1862.
 Martindale, Jos. C., M.D., Jan. 1863.
 Milliken, Jas., March, 1863.
 Maisch, John M., March, 1864.
 McCreary, J. B., May, 1865.
 *Meade, Maj. Gen. Geo. C., July, 1865.
 McQuillen, J. H., M.D., Oct. 1865.
 Maris, John M., Oct. 1865.
 Mackenzie, R. Shelton, March, 1866.
 Moore, J. G., July, 1866.
 Mayburry, Wm., M.D., Oct. 1866.
 *Marshall, Richard M., Feb. 1867.
 *Marshall, Benj., Feb. 1867.
 *Morton, Samuel C., March, 1867.
 *Magarge, Charles, April, 1867.
 *McKean, H. Pratt, April, 1867.
 *Morris, Wistar, April, 1867.
 *Morris, Israel, April, 1867.
 *Morris, Theo. H., May, 1867.
 *Moore, Andrew M., July, 1867.
 Matthews, Chas. W. Oct. 1867.
 Murphy, Edw. R., Nov. 1867.
 *Moorhead, Wm. G., Dec. 1867.
 *Magee, J. Ronaldson, Dec. 1867.
 *Magee, Horace, Dec. 1867.
 *Norris, Wm., Jr., Dec. 1830.
 Neill, John, M.D., May, 1847.
 *Norris, Octavius A., Oct., 1849.
 Newbold, Thos., M.D. (N.R.), Nov. 1854.
 Neff, Chas., M.D., April, 1858.
 Norris, Geo. W., M.D., May, 1858.
 *Norris, Wm. F., May, 1858.
 *Norris, Thaddeus, May, 1858.
 Norris, Isaac, M.D., Jan. 1861.
 *Nebinger, A., M.D., July, 1866.
 Nolan, Edw. J., M.D., April, 1867.
 Newkirk, Matthew, Nov. 1867.
 *Ord, George, Sept. 1815.
 Orne, Jas. H., Dec. 1865.
 Ogden, C. G., July, 1866.
 *Parmentier, N. S. (founder), Jan. 1812.
 *Pierce, Jacob, (N.R.), Dec. 1813.
 *Patterson, R. M., M.D., Jan. 1816.
 *Peale, Titian R. (N.R.), Aug. 1817.
 *Poulson, Chas. A., Sept. 1823.
 *Pennock, C. W., M.D. (N.R.), June, 1824.
 *Preston, Jonas, M.D., Jan. 1825.
 Penrose, Saml. S., Nov. 1830.
 *Peterson, Robert E., April, 1831.
 Porter, R. R., June, 1833.
 Pearsall, Robt., Dec. 1835.
 Phillips, John S., Aug. 1836.
 Pepper, Wm., M.D., Feb. 1837.
 Percival, Thomas C., Jan. 1845.
 Powel, Saml. (N.R.), July, 1847.
 *Pancoast, Jos., M.D., Dec. 1847.
 Phillips, D. B., M.D., Oct. 1852.
 Page, Wm. Byrd, M.D., April, 1853.
 *Pepper, Henry, May, 1853.
 *Price, Richard, May, 1853.
 *Platt, Wm., May, 1853.
 Pennypacker, I. A., M.D., Sept. 1854.
 Penrose, R. A. F., M.D., April, 1856.
 Packard, John H., M.D., Nov. 1856.
 Paul, Jas., M.D., March, 1857.
 *Pepper, L. S., M.D., July, 1857.

- Porter, Prof. E. D. (N.R.), Oct. 1857.
Parrish, Wm. D., May, 1859.
 Powel, John Hare (N.R.), May, 1858.
 Parker, Jos. E., M.D., July, 1858.
Peters, Francis, Jan. 1859.
Patterson, Francis E., Jan. 1859.
 Peace, Edw., M.D., April, 1859.
Peterson, Geo. W., Aug. 1859.
 *Pepper, Geo. S., July, 1860.
 Potts, Wm. (N.R.), Nov. 1860.
 Parrish, Edward, Dec. 1860.
 Powel, Robt. Hare, May, 1862.
 Porter, J. Hampden, M.D., Feb. 1863.
 Parker, Chas. F., Aug. 1865.
 Parrish, Jas. C., March, 1866.
 Parker, John B., April, 1866.
 *Patterson, Joseph, Feb. 1867.
 Procter, Wm., Feb. 1867.
 *Phillips, Moro, March, 1867.
 *Page, Joseph F., April, 1867.
 Pepper, W., M.D., Aug. 1867.
 Pepper, Geo., M.D., Aug. 1867.
 *Potter, Thomas, May, 1867.
- Queen, Jas. W., Jan. 1858.
- **Rotch, Joseph*, Feb. 1814.
 **Randolph, Richard*, May, 1814.
Richardson, Caleb, Dec. 1814.
 **Rotch, Thomas*, Feb. 1816.
Rafinesque, C. S., Feb. 1816.
 **Read, James*, Dec. 1824.
Reeve, Mark M., M.D., March, 1831.
 **Ruschenberger, W. S. W.*, M.D. (corres.), May, 1832.
Rogers, Henry D., (N.R.), Nov. 1834.
Ryan, Thomas, Jan. 1836.
 Rogers, R.E., M.D., Feb. 1837.
 **Redfield, John H.*, (corres.), Aug. 1846.
Rogers, James B., M.D., Oct. 1847.
 **Rosengarten, Saml. G.*, May, 1850.
 Remington, R. P., (N.R.), Nov. 1850.
 **Rand, B. Howard*, M. D., Jan. 1851.
 **Remington, Thos. P.*, May, 1853.
 Rogers, Fairman, Feb. 1854.
 **Rogers, W. Frederick*, March, 1855.
Rush, Madison, June, 1855.
- Rand, Theodore D., Sept. 1857.
 Ryland, K., M.D., Dec. 1857.
 Richardson, T. G., M.D., (N.R.) Jan. 1858.
 Roberts, Solomon W., April, 1860.
 Reece, Davis, (N.R.), Nov. 1860.
 **Rice, John*, April, 1861.
 Rothrock, J. T., Dec. 1864.
 Randolph, S. Emlen, Dec. 1865.
 **Reakirt, Edwin L.*, Jan. 1866.
 Reakirt, Tryon, April, 1866.
 **Rhoads, Jos. R.*, May, 1866.
 **Roberts, S. Raymond*, June, 1866.
 **Randolph, Evan*, Feb. 1867.
 Robb, Richard R., Feb. 1867.
 **Rockhill, Daniel H.*, May, 1867.
 Ralston, Rev. J. G., May, 1867.
- **Shinn, John, Jr.*, (founder), Jan. 1812.
 **Speakman, John* (founder), Jan. 1812.
 **Say, Thomas* (founder), April, 1812.
 **Stouse, Joseph*, M.D., May, 1812.
 **Say, Benjamin*, June, 1813.
Stockton, E. B., May, 1815.
 **Smith, Charles W.*, Dec. 1815.
 **Smith, Jacob R.*, Dec. 1815.
 Stewart, William, (N.R.), June, 1823.
 **Spackman, George*, M.D., July, 1825.
 **Smith, Joseph P.*, Feb. 1826.
 **Jeybert, Henry*, M.D., Dec. 1826.
Steinhaur, Rev. Dan., July, 1829.
Smith, John B., April, 1834.
 **Simmons, John* (N.R.), July, 1835.
 Shoemaker, Benj., (N.R.), Sept. 1835.
Snelling, Samuel, Aug. 1836.
 **Say, Mrs. Lucy W.*, (N.R.), Oct. 1841.
 Stephens, H. S., May, 1843.
 Sargent, F. W., M.D. (N.R.), Sept. 1847.
 **Sergeant, J. Dickinson*, Oct. 1847.
 Smith, Francis G., M.D., Feb. 1849.
 Smith, Aubrey H., Sept. 1850.
 **Smith, Charles E.*, June, 1851.
Sherman, W. L., M.D., Oct. 1851.
Sharpless, Caspar W., Jan. 1852.
 Struthers, William, Feb. 1852.
 **Seal, Thomas F.*, (N.R.), May, 1852.
 **Sheafer, P. W.*, (N.R.), March, 1853.
 **Schafhirt, Fred.*, (N.R.), March, 1853.

- *Swift, Joseph, May, 1853.
 *Sanderson, Ed. F., (N.R.), Sept. 1853.
 Smyth, Samuel, (N.R.), June, 1855.
 *Spackman, Rev. H. S. (N.R.), July, 1855.
 Smith, Alex. Hamilton, M.D., Dec. 1856.
 Souder, Edmund A., Feb. 1857.
 Scull, Gideon D., March, 1857.
 Slack, John H., M.D. (N. R.), July, 1857.
 Schmidt, Henry D., (N.R.), Feb. 1858.
 *Sommerville, Jas. M., M.D., Feb. 1858.
 Stimpson, Wm., (N.R.), April, 1858.
 Stephens, Lemuel, May, 1858.
 Stewart, Wm. H., (N.R.), Oct. 1858.
 Shoemaker, Benj. H., Oct. 1858.
 Swann, Wilson C., M.D., Feb. 1859.
 *Stewardson, Thomas, M.D., April, 1859.
 Smith, Henry H., M.D., April, 1859.
 Seitzinger, F. S., April, 1859.
 *Sparks, Thomas, May, 1859.
 *Smith, Thomas, June, 1859.
 Schell, Henry S., M.D., July, 1859.
 *Schaffer, Chas., M.D., March, 1861.
 Scattergood, Thos., Jr., Nov. 1862.
 Smith, A. K., M.D., Nov. 1862.
 Smith, Andrew H., M.D., Jan. 1863.
 Saurman, Benj. F., M.D., Jan. 1863.
 Steele, J. Dutton, (N.R.), Feb. 1863.
 Scattergood, Geo. J., Aug. 1863.
 Smith, Richard S., Feb. 1864.
 Smith, Thos. Guilford, Jan. 1866.
 Stelwagen, Thos. C., D.D.S., March, 1866.
 *Slaymaker, Samuel E., March, 1866.
 Shipley, Samuel R., April, 1866.
 Sellers, Wm., April, 1866.
 Stille, Henry, M.D., May, 1866.
 Shober, Sam. L., July, 1866.
 Sellers, Coleman, Dec. 1866.
 *Shively, Geo. S., M.D., Dec. 1866.
 Stevens, W. H., Jan. 1867.
 *Smith, Walter B., Jan. 1867.
 Stetler, John G., M.D., Feb. 1867.
 *Smith, Charles, March, 1867.
 Snowden, J. Ross, April, 1867.
 *Spencer, Charles, April, 1867.
 *Scott, Thomas A., April, 1867.
 *Sloan, Andrew W., May, 1867.
 Shoemaker, Geo. Y., Nov. 1867.
 Smith, Lloyd P., Nov. 1867.
 Sheppard, Edwin, Dec. 1867.
 Silliman, Henry R., M.D., 1867.
 Troost, Gerard, M.D. (founder), Jan. 1812.
 *Thompson, J. Edgar, Feb. 1831.
 Tuft, John B., M.D., (N.R.), May, 1831.
 *Taylor, Rich. C., (corres.), July, 1832.
 *Townsend, John K., M.D., Sept. 1833.
 Turnpenny, Frederick, M.D., Nov. 1833.
 Trudeau, James, M.D. (N.R.), Nov. 1835.
 *Trautwine, John C., April, 1852.
 Taggart, Wm. H., M.D., April, 1853.
 Turner, Thos. J., M. D., Feb. 1854.
 Tyson, Job R., May, 1854.
 Tiedeman, Henry, M.D., July, 1855.
 Taylor, William J., Feb. 1857.
 Turnbull, W. P., July, 1857.
 Tompkins, Myron, M.D., May, 1858.
 *Tryon, Geo. W., Jr., June, 1859.
 Townsend, Washington, Oct. 1859.
 Torr, Wm. S., Oct. 1860.
 Thompson, Edgar L., Nov. 1860.
 Turner, J. Paul, M.D., April, 1864.
 Thompson, Jas. C., Feb. 1865.
 Trotter, Newbold H., Dec. 1865.
 Taylor, Alfred B., Dec. 1865.
 *Turner, John, March, 1866.
 *Thomas, Joseph, M.D., April, 1866.
 Tryon, Edw. K., Jr., April, 1866.
 Taylor, T. Clarkson, (N.R.), May, 1866.
 *Turnpenny, Jos. C., Dec. 1866.
 *Taylor, Charles, March, 1867.
 *Tyler, Geo. F., April, 1867.
 *Trevor, John B., (N.R.), May, 1867.
 *Taitt, John T., May, 1867.
 Tyson, J. K., M.D., Aug., 1867.
 Thomas, Chas. H., M.D., Sept., 1867.
 Uhler, Wm. H., M.D., Jan. 1856.
 Uhler, Philip R., (N.R.), March, 1858.
 Ulke, Henry, (N.R.), April, 1858.
 Vanuxem, Lardner, June, 1815.
 *Vaux, Roberts, March, 1818.
 *Vaughan, John, March, 1822.
 *Vaux, William S., March, 1834.
 Vanderkemp, John J., M.D., April, 1854.
 Vail, Hugh D., Nov. 1860.

- Vandyke, E. B., M.D., Sept. 1866.
 *Vaux, George, Dec. 1866.
 *Vaux, Mrs. E. H., Feb'y, 1867.

Wilson, Alexander, June, 1813.
Warner, Benjamin, Feb. 1814.
Waterhouse, John F., M.D., March, 1814.
 **Warder, William S.*, Dec. 1814.
 **Wagner, William*, June, 1815.
Woollens, Jos., M.D., June, 1815.
 **Watson, Joseph*, May, 1816.
 **Wetherill, J. Price*, March, 1817.
 **Wagner, Tobias*, Oct. 1818.
 **Williams, Henry J.*, April, 1819.
 **Wetherill, William*, Feb. 1824.
 Wood, Wm. W. (N.R.), Jan. 1825.
 *Wood, Geo. B., M.D., Feb. 1825.
Ware, Nathaniel A. (N.R.), Oct. 1826.
 **Wetherill, Charles*, Nov. 1830.
 **Wistar, Richard*, Jan. 1831.
 **Wilson, Thos. B.*, M.D., June, 1832.
 Walker, A. M. (N.R.), April, 1836.
 Whelpley, James D. (N.R.), Mar. 1838.
 Wistar, Mifflin, M.D., June, 1839.
Watson, Gavin, M.D., April, 1840.
 Wetherill, Samuel, (N.R.), Nov. 1843.
 Woodhouse, Sam. W., M.D., Nov. 1845.
 **Wetherill, Chs. M.*, M.D., (N.R.), Feb. 1846.
 Whitman, Wm. E., Feb. 1848.
Wolgamuth, Francis F., Feb. 1848.
 **Wilson, Wm. S.*, June, 1848.
 **Wheatley, Chs. M.*, March, 1850.
 **Wister, Caspar*, M. D., June, 1851.
 **Welsb, William*, May, 1853.
 **Wood, Richard D.*, May, 1853.
 **Whelen, Edward S.*, June, 1853.
 Wythes, Rev. Jos. H. (N.R.), Nov. 1853.
 Woodward, J. J., M.D., June, 1855.
 West, Hilborne, M.D., Sept. 1855.
 Wilson, Joseph, M.D., Jan. 1856.
 **Weightman, Wm.*, Sept. 1856.
 Warren, Gen. G. K., (N.R.), Feb. 1857.
 Wilcocks, Alex., M.D., April, 1857.
Warren, David March, May, 1857.
 Wurts, C. S., M.D., July, 1857.
 Wharton, Henry, Feb. 1858.
 Wayne, Henry C., Feb. 1858.

 Wilson, Pierce B., (N.R.), Oct. 1858.
 Wilson, Samuel W., M.D., Dec. 1858.
 **Whitney, Jas. S.*, Dec. 1858.
 Williams, Samuel H., May, 1859.
 Wister, Owen J., M.D., June, 1859.
 White, John D., M.D., Oct. 1859.
 **White, S. S.*, D.D.S., Nov. 1859.
 **Welsh, John*, Dec. 1859.
 **Wilstach, Wm. P.*, July, 1860.
 Wood, Richard, Sept. 1860.
 **Warner, John*, (N.R.), Dec. 1860.
 **Wood Gen. K.*, M.D., (N.R.), Jan. 1862.
 **Wells, W. Lehmann*, M.D., June, 1863.
 **Wood, Horatio C., Jr.*, M.D., June, 1864.
 **Wharton, Joseph*, July, 1864.
 **Warner, Redwood F.*, Dec. 1864.
 **Winsor, Henry*, Aug. 1865.
 Wood, John B., Sept. 1865.
 Woodward, Geo. M., Jan. 1866.
 **White, Wm. R.*, Feb. 1866.
 **Wood, Edw. R.*, Feb. 1866.
 Westcott, Charles S., March, 1866.
 Webber, R. L., M.D., April, 1866.
 Walton, Joseph, April, 1866.
 Wyeth, Frank H., Sept. 1866.
 **Welsh, Samuel*, March, 1867.
 **Williamson, I. V.*, April, 1867.
 **Wheeler, Charles*, April, 1867.
 **Whitney, Asa*, May, 1867.
 **Whitney, George*, May, 1867.
 **Whitney, John R.*, May, 1867.
 **Whelen, Jas. N.*, May, 1867.
 **Whelen, Wm. A.*, May, 1867.
 **Whilldin, Alex.*, May, 1867.
 **White, Wm. R., Jr.*, May, 1867.
 Wilson, Franklin S., May, 1867.
 **Wright, Jos. A.*, May, 1867.
 **Waln, S. Morris*, June, 1867.
 Willcox, Joseph, Dec. 1867.
 **Waterman, Isaac S.*, Dec. 1867.

 **Xantus, John Louis (de Véséy)*, (N.R.)
 Dec. 1866.
 Yarrow, Harry C., M.D., May, 1863.

Zantsinger, George, Sept. 1835.
 **Zantzing, Wm. S.*, M.D. (N.R.) Oct. 1840.
 Ziegler, George J., M.D., Nov. 1856.

CORRESPONDENTS.

-
- Adrian Robert*, LL.D., 1815.
Abadie, Pedro, Lima, Peru, 1821.
Audouin, J. Victor, M.D., Paris, 1821.
Audubon, John James, New York, 1831.
Anthony, John Gould, Cambridge, Mass., 1833.
Agardh, Professor C. A., Lund, Sweden, 1834.
Auber, Pedro Allessandro, 1835.
Abadie, E. H., M.D. U. S. A., 1836.
Agassiz, Professor Louis, Cambridge, Mass., 1836.
Anton, Professor Frak., Hallé, Germany, 1840.
Alger, Francis, Boston, 1841.
Arago, M., Paris, 1843.
Avogadro, Amedeo, Turin, 1844.
Audubon, Victor G., New York, 1845.
Adams, Charles B., Amherst, Mass., 1846.
Aall, Nicolai, Christiana, Sweden, 1846.
Antisell, Thomas, M.D., New York, 1852.
Audubon, John W., New York, 1854.
Adamson, J. C., M. D., 1856.
Agassiz, Alex., Cambridge, Mass., 1864.
Anderson, Rev. M. B., LL. D., Rochester, New York, 1866.
Adams, Rev. E. E., Oxford, Delaware County, Pennsylvania, 1867.
Adams, Henry, London, 1867.
Adams, Arthur, London, 1867.
Angas, George French, Port Jackson, 1867.
- Bartram, William*, Kingsessing, Pennsylvania, 1812.
Bedwell, Thomas, Jr., Rio Janeiro, 1812.
Beelen, A., Pittsburg, Pa., 1812.
Brongniart, Alexandre, Paris, 1812.
Bruce, Archibald, M.D., New York, 1812.
Betton, Samuel, M.D., Germantown, 1815.
Beck, T. Romeyn, M.D., Albany, New York, 1816.
Bickley, Robert, Pennsylvania, 1816.
Baldwin, William, M.D., Wilmington, Delaware, 1817.
Blainville, H. Ducrotay De, Paris, 1817.
Bradbury, John, London, 1817.
Bonelli, Professor Francisco, Turin, 1818.
Brown, Samuel, M.D., Alabama, 1818.
Brantz, Lewis, Baltimore, Maryland, 1819.
Bigsby, John J., M.D., Newark-on-Trent, England, 1820.
Beudant, F. S., Paris, 1821.

- Borie, A. Amicus, Paris, 1821.
Brongniart, Adolph T., M.D., Paris, 1821.
Brewster, David, LL.D., Edinburgh, 1822.
Buckland, Rev. William, D.D., Oxford, England.
Best, Robert, Lexington, Kentucky, 1823.
Bellingeri, M. Turin, Italy, 1826.
Berzelius, Professor J. Jacob, Stockholm, 1826.
Burr, John H. M.D., Chiloe, Chili, 1829.
Bustamente, Jose Maria, Mexico, 1828.
Boué, Ami, Paris, 1830.
Barabino, Joseph, New Orleans, 1831.
Blanding, William, M.D., Providence, R. I., 1831.
Beche, Sir Henry Thomas de la, London, 1832.
Bachman, Rev. John, D.D., Charleston, South Carolina, 1832.
Beaumont, Elie De, Paris, 1833.
Beck, Lewis C., New Brunswick, New Jersey, 1833.
Bell, Thomas, London, 1834.
Burchell, William J., London, 1835.
Belot, Jule Henri, Paris, 1836.
Binney, Amos, M.D., Boston, 1836.
Blanding, Shubel, M.D., South Carolina, 1836.
Blanding, William, South Carolina, 1836.
Broderip, William J., London, 1836.
Brown, Benjamin B., St. Louis, Missouri, 1837.
Barratt, Joseph, LL. D., Middleton, Connecticut, 1837.
Backman, Professor Charles Frederick, Jena, Germany, 1840.
Bailey, Professor J. W., West Point, 1841.
Brewer, Thomas M., M.D., Boston, 1841.
Balfour, J. Hutton, M.D., Glasgow, Scotland, 1842.
Bourne, W. Oland, New York, 1844.
Boudin, J. C. M., M.D., Versailles, France, 1845.
Bey, Clot, M.D., Cairo, Egypt, 1845.
Baird, W. M., Reading, Pennsylvania, 1846.
Brown, Richard, Sidney, Cape Breton, 1846.
Bromfield, William A., M.D., Isle of Wight, 1847.
Brevoort, James Carson, Brooklyn, New York, 1847.
Barratt, John P., M.D., Barrattsville, South Carolina, 1847.
Brydges, Sir Harford J. J., Bart, England, 1848.
Blyth, Edward, Calcutta, 1848.
Blanchard, M. Emile, Paris, 1848.
Bartlett, John R., New York, 1850.
Barry, Rev. A. C., Racine, Wisconsin, 1853.
Buch Leopold von, Berlin, 1840.
Burnett, Waldo J., M.D., Boston, 1854.
Brücke, Professor E., Vienna, 1854.
Blake, W. P., Oakland, Ct., 1856.
Bland, Thomas, New York, 1858.

- Beneké, Professor F. W., M.D., Hesse Cassel, 1858.
 Barrande, Joachim, Prague, 1859.
 Bunbury, Charles J. F., London, 1859.
 Bernardi, Chev. A. C., Paris, 1860.
 Booth, Francis, M.D., London, 1862.
 Beebe, Edw. H., Galena, Ill., 1863.
 Boivin, Am., Paris, 1864.
 Brunet, Rev. Ovide, Quebec, 1865.
 Blake, Rev. Joseph, Gilmanton, New Hampshire, 1866.
 Baxter, Dr. J. H., U. S. A., Washington, D. C., 1866.
 Berthoud, E. S., Boulder City, Colorado, 1866.
 Buck, Charles Elton, New York, 1866.
 Brewer, Wm. H., New Haven, Conn., 1867.
 Bourguignat, M. J. R., Paris, 1867.
 Benson, H., Cheltenham, Eng., 1867.
 Baudon, Auguste, M.D., Bauvais, France, 1867.
 Benoit, Luigi, Messina, 1867.
 Busch, G. von dem, M.D., Bremen, 1867.
- Cooper, Thomas, M.D., LL.D., Columbia, South Carolina, 1812.
 Cleveland, Parker, LL. D., Bowdoin College, Maine, 1812.
 Chapman, Isaac, M.D., Bucks County, Pennsylvania, 1813.
 Clinton, De Witt, LL.D., New York, 1815.
 Carr, Robert, Kingessing, Pennsylvania, 1816.
 Cist, Jacob, Wilkesbarre, Pennsylvania, 1816.
 Clifford, John D., Lexington, Kentucky, 1816.
 Cogswell, Joseph H., New York, 1816.
 Cloquet, Jules, Paris, 1816.
 Collins, Baron de, Havana, Cuba, 1818.
 Cuvier, Baron George, Paris, 1818.
 Cloquet, Jules (le jeune), Paris, 1819.
 Camper, Adrain, Holland, 1821.
 Colla, Professor Luigi, Turin, 1822.
 Cooper, William, New York, 1823.
 Cass, Lewis, Detroit, 1831.
 Craft, James S., Pittsburg, Pennsylvania, 1831.
 Cohen, J. J., M.D., Baltimore, Maryland, 1833.
 Casanova, J. S., M.D., Paris, 1834.
 Crauer, Charles, St. Petersburg, Russia, 1834.
 Croom, H. P., Tallahassee, Florida, 1835.
 Cantley, Major Proby T., London, 1836.
 Children, J. G., London, 1836.
 Conybeare, William D., London, 1836.
 Curtis, John, London, 1836.
 Carus, Professor Charles G., M.D., Dresden, 1837.
 Clapp, Asahel, M.D., New Albany, Indiana, 1837.
 Clark, Lewis Meriwether, St. Louis, Missouri, 1837.

- Couthouy, Joseph P.*, Boston, 1837.
Combs, George, Edinburgh, 1838.
Clay, J. Randolph, 1839.
Carpenter, Wm. M., M.D., Louisiana, 1840.
Charlesworth, Edward, London, 1841.
Couper, J. Hamilton, Darien, Georgia, 1842.
Conyngham, Redmond, Lancaster County, Pennsylvania, 1842.
Chevrenl, R., Paris, 1845.
Chipman, Isaac L., Herton, Nova Scotia, 1847.
Cantor, Theodore, M.D., Singapore, India, 1848.
Cobb, J., M.D., Kentucky, 1848.
Couch, D. N., U. S. A., 1853.
Campbell, H. Frazer, M. D., Augusta, Georgia, 1858.
Carbonell, Celedonio, Porto Rico, 1859.
Clemens, Brackenridge, M.D., Baston, Pa., 1859.
Claparede, Edw., Geneva, 1859.
Carpenter, Wm. B., M.D., London, 1860.
Cornay, J. C., Paris, 1861.
Chapman, A. W., M.D., Florida, 1861.
Coues, Elliott, M. D., U. S. Army, Washington, D. C., 1861.
Cowan, Hon. Edgar, Pennsylvania, 1861.
Carpenter, P. P., New Montreal, C. E., 1862.
Chittenden, Hon. L. E., New York, 1863.
Craven, J. J., M.D., U. S. A., 1863.
Capillini, Giovanni, Bologna, 1863.
Clinton, Geo. W., Buffalo, 1866.
Collier, D. C., Central City, Colorado, 1866.
Credman, Herman, New York, 1866.
Carter, Samuel R., Paris Hill, Oxford County, Maine, 1866.
Caligny, M. Le Mis de, France, 1866.
Cowan, Frank, Washington City, 1866.
Crosse, H. M., Paris, 1867.
Chenu, J. C., Paris, 1867.
Chitty, Hon. Edw., Kingston, Jamaica, 1867.
Cailliaud, Fred., Nantes, 1867.
Cooper, J. G., M.D., San Francisco, Cal., 1867.
Cox, J. C., Sydney, New South Wales, 1867.
Cavada, F. F., U. S. Consul, Trinidad, 1867.
- Davis, John*, Boston, 1812.
Doddridge, C., M.D., Brook C. H., Virginia, 1812.
Drake, Daniel, M.D., Cincinnati, Ohio, 1812.
Ducatel, Julius F., M.D., Baltimore, Maryland, 1812.
Dana, Samuel L., Cambridge, Massachusetts, 1815.
Dillwyn, Lewis W., Pennllergars, Wales, 1815.
Duncan, Thomas, Rappahannock, Virginia, 1816.
Desmarest, Anselme Gaetan, Paris, 1817.

- Darlington, William, M.D., West Chester, Pennsylvania, 1918.*
Duméril, Constant, Paris, 1818.
Duvignan, M., Paris, 1820.
Dekay, James E., M.D., New York, 1821.
Dupont, Alfred, Wilmington, Delaware, 1821.
De Rivero, Mariano, Arequipa, Peru, 1821.
Deabbate, Gaspard, Turin, 1823.
Drapier, A., Brussels, 1824.
Doebereiner, Professor Johannes W., Jena, Austria, 1830.
Deshayes, G. P., Paris, 1832.
Dewey, Rev. Chester, Rochester, N. Y., 1832.
Duclos, M., Paris, 1833.
D'Orbigny, M. Alcide, Paris, 1834.
Dana, James D., New Haven, Connecticut, 1836.
De Candolle, Auguste P., Geneva, 1836.
Draper, John W., M.D., New York, 1836.
Dietz, Andrew R., St. Thomas, West Indies, 1839.
Denny, Henry, Leeds, England, 1842.
Delafield, Major Joseph, New York, 1846.
Dawson, J. W., Pictou, Nova Scotia, 1846.
Davis, Edwin Hamilton, M.D., Chillicothe, Ohio, 1847.
Dowler, Bennet, M.D., New Orleans, 1848.
Doane, George W., D.D., New Jersey, 1848.
Dewey, Henry B., Para, Brazil, 1850.
Diesing, C. M., M.D., Vienna, Austria, 1851.
Daniel, Wm. F., M.D., London, 1852.
Dalton, Henry G., M.D., Demarara, 1852.
De Candolle, Alphonse, Geneva, 1853.
Dearing, W. E., M.D., Augusta, Georgia, 1854.
Dalton, John C. W., M.D., New York, 1854.
D'Oliveira, D. Baptista, Rio de Janeiro, 1855.
Doremus, R. Ogden, M.D., New York, 1855.
Davis, J. Bernard, England, 1856.
Desmoulins, Chas., Bordeaux, 1859.
Dunker, Professor Wm., Marburg, Cassel, 1859.
De Camp, Wm. H., M.D., Grand Rapids, Mich., 1859.
Darwin, Chas., F.R.S., F.G.S., London, 1860.
Decaisne, Prof. Jos., Paris, 1862.
Dean, John, M.D., Boston, 1862.
Davis, Hon. Henry Winter, Baltimore, 1863.
Durieu de Maisonneuve, Prof., Bordeaux, 1865.
Du Bois, Prof. Alfred, Laurette, Park Co., Colorado, 1866.
Dresser, H. E., London, 1867.
Drouet, Henri, Troyes, 1867.
Do Castello de Paiva, Baron, Lisbon, 1867.
Durham, Geo. J., Austin, Texas, 1867.

Elliott, Andrew, Pennsylvania, 1812.
Escher, Henri, Switzerland, 1813.
Elliott, Stephen, Charleston, S. C., 1815.
Eandi, Chev. A. M., Vassali, Turin, 1822.
Ellis, W. Cox, Muucy, Pennsylvania, 1828.
Eaton, Amos, Troy, New York, 1829.
Eaton, H. Hulbert, M.D., Lexington, Kentucky, 1831.
Edwards, M. Milne, Paris, 1832.
Earle, John Milton, Worcester, Massachusetts, 1833.
Esenbeck, Professor C. G. Nees Von, Bonn, 1836.
Eights, James, M.D., Albany, New York, 1837.
Emmons, Ebenezer, M.D., Albany, New York, 1840.
Engelmann, George, M.D., St. Louis, Missouri, 1840.
Emerson, George B., Boston, 1840.
Ryton, Thomas C., Shropshire, England, 1846.
Eschricht Professor Daniel F., M.D., Copenhagen, 1848.
Ehrenberg, Christian G., M.D., Berlin, 1848.
Evans, John, M.D., New Harmony, Indiana, 1850.
Enderlin, Charles, M.D., New York, 1854.
Elliott, Rev. Stephen, Savannah, Georgia, 1856.
Ettingshausen, Constantine Von, 1859.
Edwards, Wm. H., New York, 1861.

Fonds, M. Faujas de St., Paris, 1812.
Fauker, Sylvanus, Connecticut, 1815.
Ferris, Z., Wilmington, Delaware, 1815.
Forster, Thomas, M.D., London, 1816.
Francis, John W., M.D., New York, 1816.
Férussac, Baron d'Audebard de, Paris, 1816.
Fowler, Samuel, M.D., Franklin, New Jersey, 1823.
Foote, John P., Cincinnati, Ohio, 1824.
Featherstonhaugh, G. W., Havre, 1830.
Frick, Henry, Northumberland, Pennsylvania, 1831.
Fitzinger, Professor Leopold, Vienna, 1832.
Falconer, Hugh, M.D., London, 1836.
Fitton, William Henry, M.D., London, 1837.
Fussel, Edwin, M.D., Indianapolis, Indiana, 1840.
Faraday, Sir Michael, London, 1847.
Fremont, John Charles, 1848.
Foster, J. W., Lake Superior, 1852.
Ford, Henry A., Glaastown, Gaboon River, Liberia, 1852.
Fox, Rev. Charles, Michigan, 1853.
Frauenfeld, Geo. Ritter von, Vienna, 1859.
Flourens, P., Paris, 1859.
French, Wm. H., White Haven, Luzerne Co., Pa., 1866.
Fischer, Paul, M.D., Paris, 1867.

- Griscom, John*, LL.D., Burlington, New Jersey, 1814.
Gibbs, George, New York, 1815.
Gilmer, Francis W., Albemarle County, Virginia, 1815.
Griffith, Thomas, M.D., Columbia, Pennsylvania, 1815.
Gorham, John, M.D., Harvard University, 1816.
Gummere, John, Burlington, New Jersey, 1816.
Garcia, Manuel de la, Madrid, 1817.
Guillemard, John, London, 1817.
Gilmore, Robert, Baltimore, Maryland, 1819.
Gray, John Edward, LL.D., London, 1823.
Germar, Professor Ernst Freidrich, Halle, Saxony, 1828.
Griffith, Edward, London, 1828.
Galbraith, John, Venango, Pennsylvania, 1831.
Green, Benjamin D., M.D., Boston, 1831.
Geddings, E., M.D., Charleston, South Carolina, 1832.
Goldfuss, Professor August, M.D., Bonn, Germany, 1832.
Grateloup, M., M.D., Bordeaux, 1836.
Gray, Asa, M.D., Cambridge, Massachusetts, 1836.
Goheen, S. M. E., M.D., Columbia, Pennsylvania, 1840.
Gesner, Abraham, M.D., St. Johns, New Brunswick, 1840.
Gould, Augustus A., M.D., Boston, 1840.
Graham, Colonel J. D., U. S. Topog. Eng., 1841.
Gliddon, George R., 1841.
Galeotti, Henry, Brussels, 1842.
Giraud, Jacob P., Jr., New York, 1842.
Gould, John, London, 1843.
Gibbes, Lewis, R., M.D., Charleston, South Carolina, 1844.
Gibbes, Robert W., M.D., Columbia, South Carolina, 1845.
Gourlie, William, Jr., Glasgow, 1846.
Gerolt, Baron Von, Washington, 1846.
Gray, George Robert, London, 1846.
Gilliss, J. M., U.S.N., Washington City, 1848.
Goodsir, John D., Edinburgh, 1849.
Girard, Charles, M.D., Paris, 1851.
Garcia, Jose Ant., G. y, Lima, Peru, 1855.
Green, John W., M.D., New York, 1856.
Guyot, Professor Arnold, Princeton, N. J., 1858.
Gill, Prof. Theodore, Washington, D. C., 1860.
Guérin, Méneville F. E., Paris, 1861.
Gay, Jacques, Paris, 1862.
Grant, Jas. A., M.D., Canada, 1863.
Grote, Augustus R., New York, 1865.
Gray, Robert, Glasgow, Scotland, 1866.
Gray, C. C., M.D., U. S. A., 1866.
Gaussoin, Eugene, Baltimore, Maryland, 1867.
Gassies, J. B., Bordeaux, 1867.
Gundlach, J., M. D., Havana, 1867.
Gurney, John Henry, Norfolk, England, 1867.

- Haüy, L'Abbé*, Paris, 1812.
 Haines, John S., Northumberland, Pennsylvania, 1814.
Hayden, Horace H., Baltimore, Maryland, 1815.
Hosack, David, M.D., New York, 1815.
 Hunt, David, M.D., Northampton, Massachusetts, 1815.
Hassenfratz, J. H., Paris, 1819.
 Hazlewood, George, London, 1821.
Hooker, Sir William Jackson, London, 1821.
Harris, Thaddeus W., M.D., Milton, Massachusetts, 1826.
Holmes, Ezekiel, M.D., Waterville College, Maine, 1826.
Horsfield, Thomas, M.D., London, 1826.
 Hadley, James, M.D., Fairfield, New York, 1828.
Hildreth, Samuel P., M.D., Marietta, Ohio, 1832.
Hitchcock, Edward, LL.D., Amherst, Massachusetts, 1832.
 Holbrook, John Edwards, M.D., Charleston, South Carolina, 1832.
 Hurry, William Cobb, Calcutta, 1832.
Hooper, Robert, M.D., London, 1834.
Herrick, Edward C., New Haven, 1836.
 Hodgkin, Thomas, M.D., London, 1837.
Henderson, Joseph, M.D., Mifflin County, Pennsylvania, 1838.
Houghton, Douglass, M.D., Detroit, 1840.
 Hubbard, Oliver P., M.D., Dartmouth College, New Hampshire, 1841.
 Henry, Joseph, LL.D., Washington City, 1843.
Herbert, Rev. William, LL.D., Manchester, England, 1843.
Hodgson, W. B., Savannah, Georgia, 1843.
 Hall, James, Albany, New York, 1843.
Humboldt, Baron Alexander Von, Berlin, 1843.
 Hayes, John Lord, Portsmouth, New Hampshire, 1844.
 Haight, Richard K., New York, 1844.
Harden, John M. B., M.D., Liberty County, Georgia, 1846.
 Hammond, Ogden, Charleston, South Carolina, 1847.
 Herschel, Sir J. F. W., Bart., London, 1847.
 Holmes, Francis S., Charleston, South Carolina, 1848.
Henry, T. Charlton, M.D., U.S.A., 1850.
 Haidinger, W. C., Vienna, 1851.
 Hyrtl, Professor Joseph, Vienna, 1851.
 Hough, Franklin B., M.D., Somerville, New York, 1851.
 Hauer, Baron von, Vienna, 1851.
 Hartlaub, G., M.D., Bremen, 1852.
 Hoy, Philo R., M.D., Racine, Wisconsin, 1853.
 Hammond, W. A., M.D., New York, 1853.
 Hartman, W. D., M.D., Westchester, Pennsylvania, 1853.
 Harney, Wm. S., U.S.A., 1857.
 Heer, Prof. Oswald, Zurich, 1859.
 Hornes, Morris, M.D., Vienna, 1859.
 Hamilton, W. J., London, 1859.
 Huxley, Prof. T. H., F.R.S., London, 1859.

- Hamlin, Dr. A. C., Bangor, Me., 1864.
 Hyatt, Alpheus, Salem, Mass., 1867.
 Hanley, Sylvanus, London, 1867.
 Hidalgo, J. Gonzales, Madrid, 1867.

 Ives, Ansel W., M.D., New York, 1817.

Jackson, William, Chester County, Pennsylvania, 1814.
James, William, Halifax, Virginia, 1816.
Jansen, Joseph, London, 1816.
Jones, William, Calcutta, 1817.
Jefferson, Thomas, LL.D., Virginia, 1818.
Jussieu, Antoine Laurent de, Paris, 1818.
Jameson, Robert, Edinburgh, 1822.
James, Edwin, M.D., U.S.A., 1823.
Jackson, Charles T., M.D., Boston, Massachusetts, 1833.
Jay, John C., M.D., Mamaroneck, West Chester Co., N. Y., 1835.
Jameson, William, M.D., Quito, Ecuador, 1836.
Jenkins, John Carmichael, M.D., Miss., 1836.
Jarvis, Rev. T. Farmer, D.D., Middletown, Connecticut, 1837.
Jones, John Coffin, California, 1838.
Johnston, James F. W., Durham, England, 1838.
Johnson, Wesley, M.D., Liberia, Africa, 1841.
Johnston, George, M.D., Berwick-on Tweed, 1841.
Johnston, John, Middletown, Connecticut, 1843.
Jackson, J. B. S., M.D., Boston, Massachusetts, 1846.
Jackson, Robert M. S., M.D., Indiana County, Pennsylvania, 1848.
Jones, William L., M.D., Riceboro, Georgia, 1848.
Jardien, Ambrose, Paris, 1851.
Jolis, Auguste le, Cherbourg, France, 1858.
Jones, Jos., M.D., Nashville, Tenn., 1858.
Jäger, Prof. Geo. F., Stuttgart, 1859.
Jones, Thos. Rymer, F.R.S., London, 1859.
Jones, Thos. Rupert, 1864.
Jeffreys, J. Gwynn, London, 1867.
Jerdon, T. C., M.D., Madras, India, 1867.

Keech, Alexander, A.F.C., Rappahannock, Virginia, 1816.
Kingsborough, Right Hon. Lord, London, 1837.
King, Henry, M.D., St. Louis, Missouri, 1840.
Kesteloot, Professor, Ghent, 1843.
King, Alfred T., M.D., Greensburg, Pennsylvania, 1844.
Kippist, Richard, London, 1846.
Korthals, P. W., M.D., Leyden, 1847.
Kaup, Professor Jean J., Darmstadt, 1848.
Kirtland, J. P., M.D., Cleveland, Ohio, 1848.
Kennedy, H. W., M.D., Buenos Ayres, 1852.

- Kirkwood, Daniel, Newark, Delaware, 1854.
 Krauss, Prof F., Stuttgard, 1859.
 Knieskern, P. D., M.D., N. Jersey, 1865.
 Kite, Thos., Cincinnati, Ohio, 1865.
 Kuster, H. C., Cassel, 1867.

Logan, Algernon Sidney, Germantown, Pennsylvania, 1815.
Le Conte, Louis, 1815.
Lakanal, Count, Paris, 1815.
Lee, Henry, Westmoreland, Virginia, 1816.
Latreille, Pierre Andre, Paris, 1817.
Lefroy, M., Paris, 1817.
Leman, M., Paris, 1817.
L'Herminier, Louis, M.D., Guadeloupe, 1817.
 Long, Stephen H., U. S. A., 1817.
 Lucas, J. A. H. (fils), Paris, 1817.
Laugier, M., Paris, 1818.
Lamarck, Chev. de, Paris, 1818.
Leach, W. Elford, M.D., London, 1818.
Lawrence, William, M.D., London, 1821.
 Leighton, James, M.D., Pittsburg, 1821.
 Lovell, Joseph, M.D., U.S.A., Washington, 1823.
Leonhard, Karl Cæsar von, Heidelberg, 1824.
 Laporte, J. L., Bordeaux, 1832.
Lesson, R. P., Paris, 1832.
 Lyell, Charles, Sir, London, 1832.
Le Beau, Justus, M.D., New Orleans, 1833.
 Lobe, M. Guillaume, Havana, Cuba, 1836.
 Laporte, Count de Castlenau, Paris, 1837.
 Liebig, Justus, M.D., Giessen, Germany, 1840.
Locke, John, M.D., Cincinnati, Ohio, 1841.
Lindley, John, Ph. D., London, 1841.
 Longchamps, Ed. de Selys, Liege, 1842.
 Lettsom, William G., Mexico, 1843.
 Lepsius, Professor Richard, LL.D., Berlin, 1843.
 Logan, Sir William E., Montreal, Canada, 1846.
 Lawrence, George N., New York, 1847.
 Lonsdale, William, London, 1847.
 Lacordaire, Th., Liege, 1848.
 Lagos, Manuel Ferreira, Rio Janeiro, 1849.
 Lund, P. W., Denmark, 1849.
Lynch, William F., U.S.N., 1852.
 Leconte, John, M.D., Columbia S. C., 1853.
 Lewis, James, M.D., Mohawk, N. Y., 1861.
 Lachmann, Johannes, Geneva, 1862.
 Lyon, Sidney S., Indiana, 1863.
 Lesquereux, Leo, Columbus, Ohio, 1865.
 Lincecum, Gideon, M.D., Long Point, Texas, 1867.

- Magnanos, Julian*, M.D., Norfolk, Virginia, 1812.
Mangouri, M., Paris, 1812.
Mercier, M., Paris, 1812.
Montral, Champvert, Guadeloupe, 1812.
Mitchill, Samuel L., LL.D., New York, 1812.
Muhlenberg, Rev. Henry, Lancaster, Pennsylvania, 1812.
Melsheimer, Rev. Frederick Valentin, Hanover, Pennsylvania, 1813.
McDowell, Ephraim, M.D., Danville, Kentucky, 1813.
Macnevin, William J., M.D., New York, 1814.
Mott, Valentine, M.D., New York, 1814.
Montgomey, Thomas W., M.D., New York, 1814.
Montgomery, Alexander, M.D., U.S.N., 1814.
Murry, James W., Seville, Spain, 1814.
Macaulay, Patrick, M.D., Baltimore, 1816.
Michaux, F. A., Paris, 1818.
Morinier, Noel de la, Paris, 1819.
Milbert, F., New York, 1821.
Mylius, C., Kronstadt, 1822.
Monger, Johannes, Leipsic, 1822.
Miot, A. F., Comte de Milito, Paris, 1825.
MacCulloch, James, M.D., London, 1829.
Mantell, Gideon A., LL.D., London, 1831.
Macgillivray, William, Edinburgh, 1831.
Martius, Professor C. F. P. von, Munich, Austria, 1832.
Mayer, Professor Hermann von, Frankfort, Germany, 1832
Mitchell, Elisha, Chapel Hill, North Carolina, 1832.
Murchison, Sir Roderick Impey, London, 1832.
Martins, Charles, M.D., Paris, 1833.
Moleon, S. G. V. de, Paris, 1833.
Macfadyn, James, M.D., Kingston, Jamaica, 1835.
MacLeay, William Sharp, London, 1836.
Menke, Charles Theodore, M.D., Pyrmont, Germany, 1837.
Macartney, John P., E.D., City of Mexico, 1838.
McFarland, Rev. James, 1838.
Mather, William W., Ohio, 1838.
Mousson, Albert, Zurich, 1839.
Michener, Ezra, M.D., New Garden, Pennsylvania, 1840.
Markoe, Francis, Washington City, 1841.
Mason, Owen, Providence, Rhode Island, 1841.
Melsheimer, F. E., M.D., York County, Pennsylvania, 1843.
Mighels, J. W., Portland, Maine, 1843.
Morris, Rev. John G., D.D., Baltimore, 1844.
Müller, Professor John, M.D., Berlin, 1845.
Morphett, John, Adelaide, South Australia, 1845.
Michel, Myddleton, M.D., South Carolina, 1849.
Malherbe, Alfred, Metz, France, 1850.
Marsh, Dexter, Greenfield, Massachusetts, 1852.
Maury, M. F., U.S.N., 1852.

- Motchkulsky, Col. Victor de*, St. Petersburg, 1854.
McClellan, Capt. George B., U.S.A., 1855.
Meek, F. B., Washington, D. C., 1856.
Müller (von), Baron Joh. Wm., 1856.
Mitchell, Prof. O. M., Cincinnati, Ohio, 1858.
Morse, Edw. S., Portland, Maine, 1859.
Marcou, Prof. Jules, Zurich, 1860.
McCartee, D. B., M.D., China, 1861.
Miles, Professor Manly, Lansing, Mich., 1864.
Maximilian, Prince of Wied, 1864.
Morgan, Lewis H., Rochester, N. Y., 1865.
Manigault, G. E., Charleston, S. C., 1866.
Marsh, O. C., New Haven, Conn., 1867.
Marsh, Geo. P., Florence, Italy, 1867.
Montrouzier, R. P., New Caledonia, 1867.
Morelet, Arthur, Dijon, France, 1867.
Mörch, Prof. O. A. L., Copenhagen, 1867.
Mabille, Jules, Dinon, France, 1867.
Mohrenstein, G. S. Von, Vienna, 1867.
- Nuttall, Thomas Sutton*, Lancashire, England, 1817.
Norwood, J. G., M.D., Madison, Indiana, 1842.
Nicollet, J. N., Washington, D. C., 1842.
Norman, Benjamin M., New Orleans, 1843.
Nott, Josiah C., M.D., Mobile, Alabama, 1845.
Nicholson, Charles, M.D., Sidney, New South Wales, 1846.
Nilsson, Professor Sv., Lund, Sweden, 1847.
Newberry, J. S., M.D., New York, 1853.
Nordmann, Alexander Von, St. Petersburg, 1854.
Newmann, Johann G., Gorlitz, 1859.
Newton, Alfred, London, 1861.
Newcomb, Wesley, M.D., Oakland, Calif., 1867.
- Oemler, Augustus J.*, Savannah, Georgia, 1812.
O'Kelly, Michael J., Dublin, Ireland, 1816.
Olmsted, Denison, New Haven, 1828.
Oakes, William, Ipswich, Massachusetts, 1830.
Owen, Prof. Richard, London, 1834.
Oken, Lorenz, Basle, Switzerland, 1837.
Owen, David Dale, M.D., New Harmony, Indiana, 1840.
Ombrosi, James, Florence, Italy, 1843.
Otis, Geo. A., M.D., U.S.A., Washington, D. C., 1866.
Osten Sacken, Baron R. von, Russian Legation, New York, 1868.
- Pierpont, William*, Barbadoes, 1812.
Poutrel, Alexander, Guadaloupe, West Indies, 1812.
Perkins, Jacob, Newburyport, Massachusetts, 1813.
Pinel, M., M.D., Paris, 1815.

- Palmer, John, Calcutta, 1817.
 Parent, M., Paris, 1820.
Poli, Joseph Harrier, M.D., Naples, 1820.
Parkes, Samuel, London, 1821.
 Pentland, J. Barclay, London, 1821.
 Porter, T. D., M.D., Columbia, South Carolina, 1822.
Prévost, Constant, Paris, 1823.
 Pickering, Charles, M.D., Boston, 1826.
Poinsett. Joel R., South Carolina, 1829.
Pitcher, Zina, M.D., Detroit, 1830.
 Peter, Robert, M.D., Lexington, Kentucky, 1835.
 Piddington, Henry, Calcutta, 1836.
Prinsep, James, Calcutta, 1836.
 Parsons, Usher, M.D., Providence, Rhode Island, 1838.
Prichard, James Cowles, M.D., Bristol, England, 1838.
 Pouchet, Professor F. A., Rouen, France, 1842.
 Phillips, John, York, England, 1843.
Percival, James G., M.D., New Haven, Connecticut, 1843.
 Porcher, Francis P., M.D., Charleston, S. C., 1849.
Perley, M. H., St. Johns, New Brunswick, 1852.
 Porter, Rev. T. C., Lancaster, Pennsylvania, 1853.
Prout, Hiram A., M.D., St. Louis, 1854.
Pratten, Henry, New Harmony, Indiana, 1854.
 Pleasonton, Alfred, U.S.A., 1857.
 Pierce, Prof. Benj., Cambridge, Mass., 1858.
 Postell, Jas., St. Simons Isle, Georgia, 1859.
 Prime, Temple, New York, 1862.
 Putnam, F. W., Salem, Mass., 1867.
 Pleasants, Henry, Pottsville, Penna., 1867.
 Pfeiffer, Louis, M.D., Cassel, 1867.
 Petit de la Saussaye, Paris, 1867.
 Poey, Prof. F., Havana, 1867.
 Philippi, R. A., M.D., Santiago, Chili, 1867.

Quincy, J. B., 1836.

Roxburgh, William, M.D., Calcutta, 1812.
Randall, John, M.D., Boston, 1816.
Risso, J. A., Nice, France, 1818.
Rucco, Julius, M.D., Naples, 1820.
Reinwardt, Prof. C. G. C., Leyden, 1821.
 Ricord, Alexandre, Paris, 1823.
 Ricord, Phillipe, Paris, 1823.
Ranzani, Camillo, Bologna, 1827.
 Rüppel, Edward, M.D., Frankfort, Germany, 1830.
 Ravenel, Edmund, M.D., Charleston, South Carolina, 1832.
 Rhea, Matthew, Columbia, Tennessee, 1832.
Richardson, Sir John, M.D., London, 1832.

- Riley, William, M.D., Baltimore, 1833.
Rose, Robert H., M.D., Silver Lake, Pennsylvania, 1833.
 Rogers, W. B., Virginia, 1834.
 Reynolds, Henry S., M.D., U.S.N., 1835.
 Reichenbach, Professor H. G. L., Dresden, 1836.
Riddell, John L., M.D., New Orleans, 1836.
 Randall, John W., Boston, 1837.
Reynolds, F. N., New York, 1837.
Redfield, William C., New York, 1841.
 Reinhardt, J. C., M.D., Brazil, 1845.
 Rich, William, Boston, Massachusetts, 1845.
 Rathvon, S. S., Lancaster, Pennsylvania, 1845.
Robb, James, Frederickton, New Brunswick, 1846.
 Retzius, Professor Andreas, Stockholm, 1846.
 Ravenel, Henry W., South Carolina, 1849.
Rio, Prof. Andres del, Mexico, 1849.
 Rauch, John H., Burlington, Iowa, 1856.
 Rutherford, Lewis M., New York, 1859.
 Römer, Prof. Edward von, Marburg, 1859.
 Rammelsberg, Prof. C. F., Berlin, 1859.
 Römer, Ferdinand, M.D., Bonn, 1859.
 Ross, Bernard R., Hudson's Bay Co.'s Service, 1861.
Reeve, Lovell, F.L.S., London, 1862.
 Reynolds, Wm. F., U.S.T.E., 1862.
Rémond de Corbineau, Auguste, San Francisco, Cal., 1863.
 Roepper, Wm. Theo., Bethlehem, Penna., 1865.
 Romanowsky, Lt.-Col. Hennadius, St. Petersburg, 1865.
 Raimond, Antonio, M.D., Lima, Peru, 1867.
 Recluz, M. C., Paris, 1867.
 Reinhardt, Prof. J., Copenhagen, 1867.
- Southern, William*, M.D., Maryland, 1812.
Silliman, Benjamin, M.D., LL.D., New Haven, 1815.
 Scott, Andrew, M.D., Newbern, North Carolina, 1815.
 Sims, Howard, Baltimore, Maryland, 1817.
Steinhauer, Rev. Henry, Bethlehem, Pennsylvania.
 Schreibers, Charles Von, Vienna, 1818.
Sparrman, Andreas, Univ. Upsal, 1818.
St. Hilaire, Geoffroy, Paris, 1818.
 Stevens, Alexander H., M.D., New York, 1819.
Schoolcraft, Henry R., Washington, 1820.
 Sealey, James, Cork, Ireland, 1820.
 Stenberg, Gaspard, Comte de, Bohemia, 1821.
Schweinitz, Rev. Lewis D. Von, Ph. D., Bethlehem, Pennsylvania, 1822.
 Savi, Professor Paolo, Pisa, 1827.
 Shepard, Charles U., New Haven, 1828.
 Sagra, Ramon de la, Madrid, 1829.

- Swainson, William*, New Zealand, 1830.
Shannon, John, Beaver, Pennsylvania, 1831.
Short, Charles W., M.D., Lexington, Kentucky, 1831.
Serres, Marcel de, Montpellier, France, 1832.
Styles, John, M.D., New York, 1834.
Saynisch, Lewis, M.D., Tioga, Pennsylvania, 1836.
Schwaegrichen, Professor Fredk., M.D., Leipsic, 1836.
Skinner, Ezekiel, M.D., Liberia, 1837.
Stacey, Col. L. R., Calcutta, 1838.
Storer, D. Humphreys, M.D., Boston, 1839.
Sager, Abram, M.D., Detroit, 1839.
Silliman, Benjamin, Jr., New Haven, 1841.
Saul, James, New Orleans, 1841.
Sowerby, George B., London, 1841.
Stephens, John L. New York, 1843.
Strain, Lt. Isaac G., U.S.N., 1843.
Sedgwick, Rev. Adam, London, 1843.
Sullivant, Wm. S., Ohio, 1844.
Smith, J. Lawrence, Louisville, Kentucky, 1846.
Savage, Rev. Thomas S., M.D., Natchez, 1846.
Smith, Lt.-Col. Charles Hamilton, London, 1846.
Squier, George E., New York, 1847.
Selby, John Prideaux, Northumberland, England, 1847.
Sturm, Jacob, M.D., Nuremberg, 1847.
Scoresby, Rev. William, Yorkshire, England, 1848.
Strickland, Hugh E., London, 1848.
Schouw, Professor J. Frederick, Ph. D., Copenhagen, 1848.
Shumard, Benjamin F., M.D., St. Louis, 1848.
Sharpey, William S., London, 1849.
Smith, Robert, St. Thomas, West Indies, 1851.
Smith, J. Brown, California, 1852.
Schaum, H., M.D., Berlin, 1852.
Sauvalle, F. A., Cuba, 1855.
Santos, C. A., Rio de Janeiro, 1855.
 • *Solar, Jose del*, Lima, 1855.
Sandberger, Guido, M.D., Wiesbaden, 1855.
Sandberger, Fridolin, M.D., Wiesbaden, 1855.
Suckley, George M.D., New York, 1855.
Steiner, Lewis H., M.D., Frederick, Md., 1855.
Sclater, Philip Lutley, London, 1856.
Spillman, Wm., M.D., Columbus, Miss., 1857.
Sorby, Henry Clifton, Sheffield, Eng., 1858.
Swess, Prof. Edward, Vienna, 1859.
Saussure, Henri de, Geneva, 1859.
Swallow, G. C., St. Louis, Mo., 1859.
Schimper, Prof. W. P., Strasburg, 1859.
Siebold, Carl Theo. von, Munich, 1859.
Smallwood, Prof. Chas., M.D., Montreal, 1860.

- Showalter, E. R., M.D., Uniontown, Ala., 1861.
 Spach, Prof. Edouard, Paris, 1862.
 Stein, Dr. Friedrich, Prague, 1862.
 Sheldon, Prof. D. S., Davenport, Iowa, 1862.
 Spinner, Hon. F. E., Washington, 1863.
 Sowerby, G. B., F.L.S., London, 1865.
 Stodder, Chas., Boston, 1865.
 Sinclair, Wm., Glasgow, 1866.
 Stauffer, Jacob, Lancaster, Penna., 1866.
 Scudder, Saml., H., M.D., Boston, Mass., 1867.
 Sewer, A. P., Lyons, 1867.
 Stearns, R. E. C., San Francisco, Cal., 1867.
 Stabile, Abbe Joseph, Milan, 1867.
 Souverbie, M., Bordeaux, 1867.
 Salvin, Osbert, London, 1867.
- Thornton, William, M.D., Washington, 1812.*
Tilden, Joseph, Boston, Massachusetts, 1812.
Turner, John, Maryland, 1814.
Travers, John, Jr., Lisbon, 1814.
Thomas, E., Baltimore, 1816.
Trescott, John S., M.D., Charleston, South Carolina, 1818.
Torrey, John, M.D., New York, 1822.
Temminck, Conrad Jacob, Leyden, 1824.
Totten, Jos. G., U.S.A., 1830.
Tait, Charles, Claiborne, Alabama, 1832.
Thompson, Allan, M.D., Edinburgh, 1834.
Trall, Thomas Stewart, M.D., Edinburgh, 1835.
Trimble, James, M.D., Williamsburg, Pennsylvania, 1836.
Trinius, Professor, M.D., St. Petersburg, Russia, 1836.
Tamnan, Professor Frederick, Berlin, 1839.
Twigg, William A., New Harmony, Indiana, 1841.
Tappan, Benjamin, Ohio, 1842.
Taylor, Julius S., M.D., Carrolton, Ohio, 1845.
Tuomey, M., Tuscaloosa, Alabama, 1845.
Tremper, Jacob C., Yates County, New York, 1845.
Tiedemann, Professor F., M.D., Heidelberg, 1848.
Tuckerman, Edward, Cambridge, Massachusetts, 1848.
Thompson, William, Belfast, Ireland, 1848.
Thurber, Geo., New York, 1861.
Thomson, John H., New Bedford, Mass., 1862.
Thackara, J. M. S., Punca, Peru, 1866.
Tröschel, Prof. F. H., Bonn, 1867.
- Unanue Hippolito, M.D., Lima, Peru, 1821.*
Ure, Andrew, M.D., Glasgow, 1829.

- Vauquelin, M.*, Paris, 1818.
Van Hoorebeke, Charles Joseph, Ghent, 1821.
Van Reusselaer, Jeremiah, M.D., New York, 1829.
Voltz, Louis Phillippe, Strasburg, Germany, 1833.
Vargas, Jose Maria, M.D., Caracas, Venezuela, 1835.
Van Rensselaer, Stephen, Albany, New York, 1835.
Vancleve, John, Dayton, Ohio, 1843.
Verneuil, Edward de, Paris, France, 1846.
Verreaux, Jules, Paris, 1848.
Van Beneden, P. J., Bruxelles, 1864.
Vaillant, Leon, M.D., Paris, 1867.
- Wallich, Nathaniel, M.D.*, Calcutta, 1819.
Wetherill, Samuel R., Burlington, New Jersey, 1814.
Webster, John W., M.D., Cambridge, Massachusetts, 1814.
Wheelwright, Joseph, M.D., Kentucky, 1814.
Wister, Charles J., Germantown, Pennsylvania, 1814.
Wray, Thomas J., M.D., Augusta, Georgia, 1818.
Worth, James, Bucks County, Pennsylvania, 1823.
Wiedeman, D. R. G., M.D., Kiel, Germany, 1823.
Ward, Malthus A., M.D., Athens, Georgia, 1832.
Warder, John A., M.D., Cincinnati, Ohio, 1842.
Warren, John C., M.D., Boston, Massachusetts, 1842.
Wyman, Jeffries, M.D., Boston, Massachusetts, 1844.
Wilson, Edward, Pembrokeshire, Wales, 1846.
Wood, W. Maxwell, M.D., U.S.N., 1847.
Waldheim, Fischer, de, Moscow, 1848.
Webber, Samuel, M.D., New Hampshire, 1851.
Whitney, J. D., Boston, 1852.
Wagner, Professor A., Munich, 1852.
Wailes, B. L. C., Washington, Mississippi, 1854.
Winslow, R. K., Cleveland, Ohio, 1854.
Wright, W. W., York Springs, Pa., 1859.
Wynne, James, M.D., New York, 1861.
Woodworth, John M., Chicago, 1861.
Walsh, Benjamin D., Illinois, 1861.
Wisely, J. J., M.D., Sioux Falls, Dakota Territory, 1866.
Willis, John R., Halifax, Nova Scotia, 1867.
Winchell, Alexander, Ann Arbor, Mich., 1867.
Wood, Rev. Alphonso, Brooklyn, N. Y., 1867.
- Yarrell, William*, London, 1829.
- Zollickoffer, William, M.D.*, Middletown, Maryland, 1834.
Zimmerman, Chr., M.D., Columbia, South Carolina, 1836.
Ziegler, Rev. Daniel, York, Pennsylvania, 1844.
Zuccarini, Professor Joseph G., Munich, Bavaria, 1846.
Zaremba, C. William, St. Joseph's, Mich., 1867.

INDEX OF GENERA.

1867.

| | | | |
|-----------------------|---------------|---------------------|--------------|
| Acalypha..... | 22 | Carditamara..... | 139 |
| Achlya..... | 93 | Cardium..... | 139 |
| Aëtobatis..... | 193, 156 | Carpocapsa..... | 80 |
| Agriochærus..... | 32 | Carpophaga..... | 131 |
| Alauda..... | 217 | Cassia..... | 19 |
| Alopecurus..... | 23 | Cassiculus..... | 67 |
| Amblycerus..... | 73 | Cassicus..... | 63 |
| Amblystoma..... | 167 | Castor..... | 135 |
| Ammania..... | 19 | Castoroides..... | 97 |
| Ampelis..... | 217 | Caudisonia..... | 85 |
| Anagallis..... | 21 | Centaurea..... | 20 |
| Andigena..... | 122 | Cercopithecus..... | 12 |
| Anodonta..... | 81 | Cermatia..... | 42 |
| Anomia..... | 139 | Cervus..... | 136 |
| Anthropopithecus..... | 34 | Chama..... | 139 |
| Antilocarpa..... | 136 | Chamsodelphis..... | 153 |
| Aramides..... | 234 | Charcharodon..... | 142 |
| Arca..... | 139 | Cheiomys..... | 38 |
| Archæopteryx..... | 234 | Chelone..... | 143 |
| Archiplanus..... | 68 | Chelopus..... | 86 |
| Artemisia..... | 16, 20 | Chenopodina..... | 22 |
| Arvicola..... | 136 | Choeropsis..... | 12 |
| Astarte..... | 139 | Chrysopa..... | 76 |
| Aster..... | 16, 20 | Clypicterus..... | 72 |
| Asperula..... | 19 | Coleonyx..... | 85 |
| Atriplex..... | 16 | Collinsia..... | 21 |
| Aturia..... | 40 | Colophonodon..... | 151, 153 |
| Aulacorampus..... | 118 | Conobea..... | 21 |
| Axinæa..... | 139 | Corbula..... | 139 |
| | | Corvus..... | 216 |
| Balanus..... | 139 | Crasatella..... | 139 |
| Balæna..... | 132, 144, 156 | Croton..... | 22 |
| Balænoptera..... | 144 | Cryptodira..... | 40 |
| Basilosaurus..... | 144, 155 | Cryptops..... | 129 |
| Batatas..... | 21 | Cyclocardia..... | 139 |
| Bathynathus..... | 234 | Cynocephalus..... | 35 |
| Beauharnaisius..... | 114 | Cynodon..... | 16, 23 |
| Beluga..... | 144 | Cynomys..... | 135 |
| Bison..... | 12, 85 | Cynorca..... | 144, 151 |
| Bos..... | 12 | Cyperus..... | 23 |
| Bothremys..... | 40 | Cyprinella..... | 157 |
| Bothroplys..... | 128 | | |
| Brevoortia..... | 81 | Dactyloctenium..... | 24 |
| Brizopyrum..... | 24 | Dactylosphæra..... | 2 |
| Brodiea..... | 82 | Daubentonina..... | 38 |
| Buceros..... | 215 | Delphinus..... | 144 |
| Bursa..... | 139 | Dichelostemma..... | 82 |
| | | Dichondra..... | 21 |
| Cakile..... | 18 | Dicotyles..... | 12, 138, 155 |
| Calamintha..... | 21 | Didus..... | 130 |
| Camarataxis..... | 167 | Diodia..... | 20 |
| Canis..... | 134 | Dione..... | 139 |

| | | | |
|---------------------|---------------|----------------------|----------|
| Dipodomys..... | 135 | Hypsilepis..... | 157 |
| Doryodon..... | 144, 154 | Hysiprymnus..... | 12 |
| Dosinia..... | 139 | Hyrax..... | 12 |
| Dromococyx..... | 233 | | |
| Dechellada..... | 36 | Icterus..... | 46 |
| | | Iguanodon..... | 234 |
| Ecphora..... | 139 | Ipomea..... | 21 |
| Ensatina..... | 167 | Isocardia..... | 139 |
| Equus..... | 12 | Isognomon..... | 139 |
| Erethizon..... | 136 | Iva..... | 20 |
| Ervum..... | 19 | Iulus..... | 43, 129 |
| Erysimum..... | 17 | | |
| Eschrichtius..... | 131, 144, 146 | Juncus..... | 22 |
| Eucastes..... | 31, 39, 40 | Jussiaea..... | 19 |
| Eupatorium..... | 20 | Kosteletzkya..... | 18 |
| Eupherusa..... | 232 | | |
| Euphorbia..... | 22 | Laelaps..... | 234 |
| Eustachys..... | 23 | Lamna..... | 142 |
| Euxolus..... | 22 | Lanius..... | 215 |
| | | Larus..... | 217 |
| Falco..... | 213 | Leococoryne..... | 82 |
| Felis..... | 133 | Leontodon..... | 21 |
| Fiber..... | 136 | Leptocaulis..... | 19 |
| Fimbristylis..... | 23 | Leptochloa..... | 24 |
| Fissurella..... | 139 | Leptoptila..... | 94 |
| Fuirena..... | 23 | Lepus..... | 136 |
| | | Lipocarpa..... | 23 |
| Galago..... | 37 | Lithobius..... | 130 |
| Galeocercus..... | 141 | Lopezia..... | 33 |
| Galera..... | 138, 155 | Lophocetus..... | 144, 146 |
| Galium..... | 20 | Lucina..... | 139 |
| Gaura..... | 19 | Lunatia..... | 139 |
| Geomys..... | 97 | Lygaeus..... | 75 |
| Geophilus..... | 128 | | |
| Geotrygon..... | 130 | Macacus..... | 36 |
| Gerardia..... | 21 | Macrophoca..... | 153 |
| Glaucis..... | 232 | Madrepora..... | 139 |
| Glottidium..... | 19 | Malvastrum..... | 18 |
| Glyceria..... | 24 | Manatus..... | 138 |
| Glycimeris..... | 119 | Margaritana..... | 81 |
| Gossypium..... | 18 | Mecistocephalus..... | 128 |
| Grammarhynchus..... | 112 | Medicago..... | 18 |
| Gryphaea..... | 40 | Megalobatrachus..... | 167 |
| | | Megaptera..... | 32 |
| Helenium..... | 20 | Melilotus..... | 18 |
| Heliotropium..... | 21 | Mercenaria..... | 139 |
| Hemipristis..... | 142 | Merops..... | 217 |
| Hemicarpha..... | 23 | Metis..... | 139 |
| Herpestis..... | 21 | Micropus..... | 75 |
| Heredia..... | 167 | Modiola..... | 18 |
| Hesperomys..... | 135 | Motacilla..... | 219 |
| Heterotriton..... | 167 | Muscicapa..... | 218 |
| Hetherotheca..... | 20 | Mycetes..... | 36 |
| Hippodamia..... | 76 | Myliobatis..... | 140, 156 |
| Hydraspis..... | 41 | | |
| Hyla..... | 85 | Nama..... | 21 |
| Hylobates..... | 12 | Neotoma..... | 135 |
| Hynobius..... | 167 | Noëtia..... | 139 |
| Hyphantes..... | 61 | Notidanus..... | 141 |

| | | | |
|------------------------|---------------|-----------------------|-------------------------|
| Obione..... | 22 | Salisburya | 83 |
| Ocylus | 71 | Salsola | 16, 17 |
| Oecodoma | 24 | Sagina | 18 |
| Oenothera | 19 | Scala | 139 |
| Ontocetus | 144 | Scaphiopus | 85 |
| Oldenlandia | 20 | Sciara | 222 |
| Onychodactylus | 167 | Sciurus | 134 |
| Orbicula | 129 | Scolopocryptops | 128 |
| Oriolus | 217 | Scops | 99 |
| Orycterocetus | 144 | Scytotis | 85 |
| Osteocephalus | 85 | Selenidera | 115 |
| Ostinops | 68 | Semnopithecus | 12 |
| Ostrea | 139 | Senebiera | 16, 17 |
| Otodus | 142 | Sesbania | 19 |
| Ovis | 136 | Sesuvium | 18 |
| Oxyrhina | 142 | Sida | 18 |
| Paludina | 81 | Simia | 12, 37 |
| Panicum | 24 | Sinapis | 17 |
| Parthenium | 20 | Solidago | 20 |
| Parus | 221 | Sphaerula | 139 |
| Paspalum | 24 | Spartina | 23 |
| Pecten | 139 | Spea | 85 |
| Pendulimus | 54 | Spermophilus | 134 |
| Peltocephalus | 40 | Sphinx | 80 |
| Perognathus | 135 | Sphyræna | 142 |
| Petunia | 21 | Sphyrna | 142 |
| Phaenicothraupis | 94 | Spirobolus | 129 |
| Phenacobius | 96 | Sporobolus | 23 |
| Phoca | 153 | Squalodon | 132, 144, 150, 151, 156 |
| Photogenis | 163 | Stinodon | 151 |
| Phyllanthus | 22 | Strigamia | 128 |
| Physeter | 144 | Stropholirion | 82 |
| Picus | 217 | Sus | 12 |
| Pinna | 139 | Tachyphonus | 94 |
| Piperivorus | 117 | Tamias | 134 |
| Plagiostoma | 156 | Tapirus | 12 |
| Plantago | 21 | Teredo | 40 |
| Pleurodira | 40 | Thaumatias | 233 |
| Plethodon | 167, 207 | Thecachampsæ | 143 |
| Pliorhytis | 139 | Thomomys | 135 |
| Pluchea | 16, 20 | Thoracosaurus | 40 |
| Podocnemis | 40 | Trachycephalus | 85 |
| Polydesmus | 43, 129 | Tragus | 12 |
| Polygonum | 22 | Trifolium | 18 |
| Polypremum | 20 | Trionix | 40, 142 |
| Portulaca | 18 | Troglodites | 12, 35 |
| Potentilla | 19 | Turritella | 139 |
| Priscodelphinus | 144, 145, 156 | Unio | 81 |
| Pteroglossus | 101, 108 | Ursus | 134 |
| Pyrosteria | 113 | Vaucheria | 93 |
| Pyrrhopappus | 21 | Verbena | 21 |
| Raja | 41, 156 | Vespertilio | 133 |
| Ramphoxanthus | 120 | Vigna | 19 |
| Rhabdosteus | 132, 144, 146 | Vitis | 42, 98 |
| Rhamphastos | 100, 123 | Xiphonura | 167 |
| Rhinoceros | 12 | Zizyphinus | 139 |
| Rhinochilus | 85 | | |
| Roubiera | 22 | | |

GENERAL INDEX.

- Allen, Dr. H., On certain features in the conformation of the mammalian skull, 11; Election as Corresponding Secretary, 14; Remarks on the tertiary occipital condyle, 137.
- Bache, Prof. Alex. Dallas, Announcement of death of, 11.
- Barnes, O. N., Resignation of membership, 32.
- Bridges, Dr. R., Announcement of the publication of volume 6, part 2, of Journal, 97.
- Cassin, John, A third Study of the Icteridæ, 39, 45; A Study of the Rhamphastidæ or Toucans, 97, 100; Fasti Ornithologiæ, No. III., 139, 212.
- Clemens, Dr. Brackenridge, Announcement of death of, 11.
- Committees, Standing, for 1867, 14.
- Conchological Section, Announcement of organization, 14.
- Cope, Edw. D., Exhibition of skull of *Eucastes platyops*, 31; On *Eucastes*, a genus of extinct Cheloniidæ, 32, 29; Remarks on Megaptera, 32; Exhibition of vertebræ of *Thoracosaurus brevispinus*, 39; Contributions to the History of the Vertebrates of Mesozoic Period in New Jersey and Pennsylvania, 74, 75; On the Families of Raniform Anura, 83, 84; Remarks on a collection of Reptiles from Owen's Valley, 85; Description of a new genus of Cyprinoid Fishes, 95; Remarks on four species of extinct Mammalia, 131; An addition to the vertebrate Fauna of the Miocene Period of the United States, 132, 138; Remarks on the contents of caves of South-western Virginia, 137; A review of the species of *Amblystoma*, 138, 166; On the Genera of fresh water Fishes *Hypsilepis*, Baird, and *Photogenis*, Cope, 138, 156; On the distribution of fresh water Fishes in the Alleghany Region of South-western Virginia, 138; On the habits of a Tipulideous Larva, 222; Remarks on extinct reptiles which approached the birds, 234.
- Correspondence of the Academy for 1867, 244.
- Coues, Dr. Elliott, Notes on a Collection of Mammals from Arizona, 125, 133.
- Dewey, Rev. Dr. C., Announcement of death of, 138.
- Diesing, Dr. C. M., Announcement of death of, 74.
- Donations to the Museum, 246.
- Donations to the Library, 251.
- Elliot, D. G., Description of a new species of Owl of the Genus *Scops*, 94, 99.
- Elliott, Rev. Stephen, Announcement of death of, 1.
- Election of Officers for 1868, 242.
- Election of Members and Correspondents during 1867, 243.
- Ennis, Prof. J., The necessity of Nebular Rotation, 31, 87; The Mechanical theory of Solar Heat, 226.
- Faraday, Prof. Michael, Announcement of death of, 132.
- Featherstonhaugh, Prof. Geo. W., Announcement of death of, 1.
- Genth, Dr., Observation on certain doubtful Minerals, 86.
- Heintzleman, J., Resignation of membership, 14.
- Hill, Richard, Note on *Geotrygon sylvatica*, Gosse, 130.

- Holmes, Prof., Exhibition of remains of prehistoric man from Charleston, S. C., 125.
- Howell, Dr. S. B., Election as Recording Secretary, 14.
- Index of Genera, 308.
- Jager, Dr. George, Announcement of death of, 38.
- Jeanes, Jos., Resignation as Corresponding Secretary, 14.
- Kennisott, Robert, Announcement of death of, 11, 32.
- Lawrence, Geo. N., Notes on certain Birds from New Grenada, with description of new species, 87, 94; Description of Five new species of Central American Birds, 232.
- Lea, Isaac, On two new Minerals from Chester County, 39, 44; Description of five new Unionidæ, 74, 81.
- Le Conte, Dr. J. L., Remarks on Cretaceous coal beds of New Mexico, 132.
- Leeds, Prof., Remarks on the inspiration of oxygen, 74.
- Leidy, Dr. Jos., Exhibition of plate of forthcoming work on extinct Mammals, 32; On fossil Hippopotamus, 32; Remarks on the skull of *Bison latifrons*, 85; Mention of the appearance of the seventeen year locust, 93; Exhibition of the skull of *Geomys bursarius*, 97; Of an antique copper hammer, 97; Of the skull of *Castoroides Ohioensis*, 97; Of specimens of black hornstone, 125.
- Lincecum, G., On the Habits of the Cutting Ants of Texas, 11, 24.
- Lyman, B. S., On the Great Carboniferous Conglomerate in Sullivan County, Pa., 125.
- Marshall, Richard M., Announcement of death of, 138.
- Maximilian, Prince de Wied, Announcement of death of, 31.
- Meehan, Thos., On the Structure of *Lopezia*, 31, 33; On the dioecious forms of *Vitis vinifera*, 38, 42; Additional Notes on male forms of *Vitis vinifera*, 94, 98.
- Morris, Miss Margaretta H., Announcement of death of, 82.
- Morton, S. C., Announcement of death of, 39.
- Norris, Wm., Announcement of death of, 11.
- Pennock, Dr. C. W., Announcement of death of, 39.
- Pierce, Jacob, Announcement of death of, 138.
- Report of the Curators, 235.
- Report of the Librarian, 237.
- Report of the Recording Secretary, 238.
- Reports of the Conchological Section, 238.
- Sanderson, Edw. F., Announcement of death of, 1.
- Sherman, W. L., Announcement of death of, 32.
- Shimer, Dr. Henry, On a new genus of Homoptera, 2; Notes on *Micropus leucopterus*, 74, 75; Additional Note on the Chinch-Bug, 234.
- Slack, Dr. J. H., Mammalogical Notices, 31, 34.
- Smith, A. H., On Colonies of Plants observed near Philadelphia, 11, 15.
- Starr, J., Resignation of membership, 14.
- Tryon, Geo. W., Jr., Letter accompanying deposit of shells, 39, 84; deposit of Library, 74.
- Wetherill, Dr. Chas. M., On *Itacolumite*, 13.
- Wood, Alphonso, Description of a new genus of Plants, 74, 81.
- Wood, Dr. H. C., Resignation as Secretary, 1, 14; Description of new Texas Myriapoda, 39, 42; Remarks on spiral ducts in *Salisburia adiantifolia*, 83; Observation on the life history of certain siphonaceous fresh water algæ, 93; Remarks on fresh water algæ from thermal springs, 125; Notes on a Collection of California Myriapoda, 125, 127.
- Zimmerman, Dr. Chas., Announcement of death of, 138.

PROCEEDINGS

OF THE

ACADEMY OF NATURAL SCIENCES

OF

PHILADELPHIA.

1868.

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1868.



LIST OF CONTRIBUTORS,

With references to the several Articles contributed by each.

| | |
|---|----------|
| Butcher, H. B. List of Birds collected at Laredo, Texas, in 1866 and 1867, | 148 |
| Cope, Edw. D. An examination of the Reptilia and Batrachia obtained by the Orton expedition to Equador and the Upper Amazon, with notes on other species..... | 96 |
| Second Contribution to the History of the Vertebrata of the Miocene period of the United States..... | 184 |
| On the Crocodilian genus <i>Perosuchus</i> | 203 |
| Synopsis of the Extinct Batrachia of North America..... | 208 |
| On <i>Agaphelus</i> , a genus of toothless Cetacea..... | 221 |
| On some Cretaceous Reptilia..... | 233 |
| On the Origin of Genera..... | 242 |
| Sixth Contribution to the Herpetology of Tropical America..... | 303 |
| Observations on Reptiles of the Old World, Art. II..... | 316 |
| Coues, Elliot. A Monograph of the Alcidae..... | 2 |
| List of Birds collected in Arizona by D. E. Palmer; with remarks..... | 81 |
| Lawrence, Geo. N. Description of seven new species of American Birds from various localities, with a note on <i>Zonotrichia melanotis</i> | 359, 429 |
| Lea, Isaac. Description of nine species of Unionidae from Lake Nicaragua, Central America..... | 94 |
| Description of sixteen new species of the Genus <i>Unio</i> of the United States..... | 143 |
| Notes on some singular forms of Chinese species of <i>Unio</i> | 145 |
| Descriptions of four new species of Exotic Unionidae..... | 150 |
| Descriptions of seven new species of <i>Unio</i> from N. Carolina..... | 160 |
| Description of two new species of Unionidae from Equador..... | 161 |
| Descriptions of Unionidae from the Lower Cretaceous Formation of New Jersey. | 162 |
| LeConte, J. L. Analytical table of the species of <i>Baridius</i> inhabiting the United States | 361 |

| | |
|--|-----|
| The Gyrinidæ of America, north of Mexico..... | 365 |
| Notes on the Species of <i>Agonoderus</i> , <i>Bradycellus</i> and <i>Stenolophus</i> inhabiting America north of Mexico..... | 373 |
| Leidy, Jos. Notice of some Vertebrate Remains from Harden Co., Texas.. | 174 |
| Indication of an Elotherium in California..... | 177 |
| Notice of some Reptilian Remains from Nevada..... | 177 |
| Notice of some Vertebrate Remains from the West Indian Islands..... | 178 |
| Notice of some remains of Horses..... | 195 |
| Notice of some extinct Cetaceans | 196 |
| Remarks on a jaw fragment of <i>Megalosaurus</i> | 197 |
| Remarks on <i>Conosaurus</i> of Gibbes..... | 200 |
| Notice of American Species of <i>Ptychodus</i> | 205 |
| Notice of some American Leeches..... | 229 |
| Notice of some remains of extinct <i>Pachyderms</i> | 230 |
| Notice of some remains of extinct Insectivora from Dakota..... | 315 |
| Meehan, Thos. Sexual Law in <i>Acer dasycarpum</i> Ehrb. | 140 |
| Variations in <i>Epigæa repens</i> | 153 |
| Monœcism in <i>Luzula campestris</i> | 156 |
| <i>Mitchella repens</i> , M., a dioecious plant..... | 183 |
| Variations in <i>Taxodium</i> and <i>Pinus</i> | 300 |
| On the Seed Vessels of <i>Forsythia</i> | 334 |
| Meek, F. B. and A. H. Worthen. Notes on some points in the Structure and Habits of the Palæozoic Crinoidea..... | 323 |
| Remarks on some types of Carboniferous Crinoidea, with descriptions of new genera and species of the same, and of one Echinoid | 335 |
| Norris, Thaddeus. Remarks on a New Species of <i>Osmerus</i> (<i>O. Sergeanti</i>). | 93 |
| Rand, Theo. D. On a New Mineral in Cryolite..... | 143 |
| Reakirt, Tryon. Descriptions of some New Species of Diurnal Lepidoptera. | 87 |
| Wood, Alph. A sketch of the Natural Order Liliaceæ..... | 163 |

TO CONCHOLOGISTS.

The Conchological Section of the Academy of Natural Sciences of Philadelphia, in announcing the commencement of the *Fourth annual Volume* of the American Journal of Conchology, now published under its auspices, desires to impress upon you the importance of this Journal to all working Conchologists as well as to Collectors and Amateurs and those interested in Natural History generally.

The "Journal" is the only publication of its kind in the English language, and is so universally acknowledged to be the chief exponent of the science, that its pages contain the entire contributions of nearly every American Conchologist, thus uniting into one publication, what was previously scattered through numerous Natural History Journals, and bringing within the reach of all, the means of keeping fully posted in the progress of this useful, elegant and popular science.

Its contributors include all the distinguished Conchologists of America, as well as many Europeans of distinction. Besides papers of strictly scientific character, the "Journal" has always included original and selected matter of a more popular description, not omitting monographs of Families or Genera of American Shells, fully illustrated and specially designed to assist the local collector in identifying his species. The three volumes of the "Journal" already published, contain a monograph of the Melanians of the United States, with nearly a thousand illustrations on wood, and a monograph of our Terrestrial Species, with eighteen lithographic plates. Other papers of the same useful character will be published hereafter, as opportunity offers. The reviews of new books, contain a complete bibliographical record—every new fact in Conchology is quoted and commented upon—and every new genus and species is catalogued, and when practicable and necessary, criticised.

The volume (3d) of the "Journal" just completed, contains over 400 pages, and twenty-six beautiful colored and plain lithographic plates and portraits.

The "Journal" has been published heretofore at Ten Dollars per annum, which has not repaid the cost. It has been suggested that at a lower price, a very much larger subscription list can be obtained, and in order to test this, your subscription is solicited, either *with or without limitation of price*.

We hope to have a reply at your earliest convenience.

GEO. W. TRYON, JR., } *Pub. Com. of the Conchological Section*
 ISAAC LEA, L.L.D., } *of the*
 E. J. NOLAN, M. D., } *Academy of Natural Sciences.*

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PROCEEDINGS
OF THE
ACADEMY OF NATURAL SCIENCES
OF
PHILADELPHIA.

1868.

Jan. 7th, 1868.

The President, DR. HAYS, in the Chair.

Thirty-three members present.

The following papers were presented for publication :

"Description of some extinct fishes, previously unknown." By E. D. Cope.

"Monograph of the Alcidae." By Elliott Coues, M. D., U. S. A.

Jan. 14th.

MR. VAUX, Vice-President, in the Chair.

Twenty-six members present.

The death of Edward B. Grubb, of Burlington, N. J., a member of the Academy, was announced.

On leave being granted, the Committees on the following papers reported in favor of their publication in the Proceedings :

"On the habits of a Tipulideous Larva." By E. D. Cope.

"Mechanical theory of Solar Heat." By Jacob Ennis.

"Description of five new species of Central American Birds." By Geo. N. Lawrence.

On motion, it was resolved that these papers should be printed in the Proceedings for December, 1867.

Jan. 21st.

MR. CASSIN, Vice-President, in the Chair.

Twenty-three members present.

1868.]

The following paper was presented for publication :
 "List of birds collected in Southern Arizona by Dr. E. Palmer,
 with remarks by Dr. Elliott Coues, U.S.A."

E. D. Cope made some observations on some specimens of Vertebrata presented by Wm. M. Gabb, of San Francisco, which were procured by him in western Nevada and the northern part of Lower California.

Of reptiles were two undescribed species of Boas, thus increasing the species of the Fauna Nearctica to four, all of which belong to the family Lichanuridae Cope. The new species belong to *Lichanura* Cope, and are thus characterized: *L. roseofusca*; scales in 36 series, those in the orbital ring seven or eight, the anterior fused into a large preocular. Loreals $\frac{3}{4}$. Color brown above. Belly and especially gular region pink shaded. Length two feet five inches. *L. myriolepis*; scales in 45 rows, those in the orbital ring of equal size, ten in number; loreals $\frac{3}{4}$. Color leaden blue, with three rusty red bands extending throughout the length, but very indistinct on the anterior half of the body.

Of mammalia he noticed a good specimen of the *Lagomys princeps*, from an elevation of 10,000 feet on the Sierra Nevada, near lat. 32°, a locality about 10° further south for the genus than had been hitherto recorded for this continent. Another interesting species was an *Arvicola*, allied to the *A. modesta* of Baird, but not described, from Pigeon Springs, on the eastern boundary line of California, east of Owen's Valley. The characters are as follows: *Arvicola curtata* Cope; one of the smallest species of the genus, differing from *A. modesta* in its much shorter hind foot and tail, in the lower anterior molar with two external triangles instead of three, in the very light color, and other points. Ears well developed, the marginal half loosely furred externally; long silky hairs from the meatus within, on the exterior two-thirds. Anterior lower molar with a posterior triangle, three internal and two external triangles, with an open trefoil. Tail vertebrae a little shorter than the hind foot, and about one-half the head. Hind foot a little over half the head, and five thirds the length of the fore foot. Some long hairs at the bases of the toes, posterior half of the sole densely hairy. Hair on upper surface of feet very long, concealing the claws. Fur rather long, dense, base dark leaden, followed by a light grey, and light brown tip on the upper parts of head and body; general resulting color above light greyish brown; below and feet white.

| | In. | Lin. |
|-----------------------------------|-----|------|
| Length to end tail vertebrae..... | 2 | 8.4 |
| " head, (slightly crushed)..... | | 10.7 |
| " tail vertebrae..... | | 4.8 |
| " ear from meatus..... | | 2. |
| " fore foot..... | | 3.8 |
| " hind foot..... | | 6. |
| " whiskers..... | | 10.8 |

On favorable reports of the Committees, the following papers were ordered to be published:

A Monograph of the ALCIDÆ.

BY ELLIOTT COUES, A.M., M.D.

Assistant Surgeon United States Army.

"Hinc bonus Moehringiæ, boni Brissoniæ, Kleinæ, Linnaei cet. sed in medio in omnes veritas et Naturæ ordo!"—*Fallas.*

The *Alcidæ* contained in the collections of the Smithsonian Institution, Washington; the Academy of Natural Sciences, Philadelphia; the Society of Natural History, Boston; the Essex Institute, Salem; and in the private cabi-

[Jan.

net of Mr. Geo. N. Lawrence, of New York, have been examined in the preparation of the present memoir. The writer tenders his acknowledgements to the officers having immediate charge of these collections, for numerous favors shown him, in a variety of ways, during the prosecution of his researches.

Nearly all the known species of the family are represented in the several collections above named; and the libraries of these Institutions contain all needed works of reference. Being based upon such ample data, this monograph ought to embody all that is known of the *Alcidæ* in a technical point of view, and constitute a fair exponent of the same. The writer ventures to indulge the hope that it may not be found to fall far short of this standard.

Before proceeding to the proper matter of the subject, it may be well to glance at what has already been done in this family of birds. Following is a list, in chronological order, of the principal works in which *Alcidæ* are made more or less of a specialty, with remarks upon each. It is obviously by no means a bibliography of the family; only those works being noticed in which some special point is presented. It may pass, however, for a reviewing sketch of the literature of the subject, and as such may be valuable and helpful to the student. Consultation of most of the works mentioned below is absolutely necessary to a correct understanding of the subject, except in so far as it may be obviated by perusal of the text of the present paper.

I. Review of the Literature of the Family.

Certain species of *Alcidæ* made their appearance in the very earliest ornithological writings of which we have any knowledge, long before the establishment of the science upon any fixed and recognized basis. However desirable it may be—as well in justice to early authors, as tending to bring the whole subject in the strongest light—to collate and identify, as far as possible, the older names of these species, the attempt to cite as authoritative names and descriptions which antedate the foundation of the binomial system of nomenclature would be at once embarrassing and profitless. There must be a fixed initial point for the commencement of authority in the matter of names in the existing system of zoological nomenclature; otherwise a writer might adopt names at pure caprice; in which event the species he treats of would be recognizable only by synonymy adduced, or descriptions appended, and names would fail of their proper purpose by becoming simply indices of the extent of his philological research. The date of the tenth edition of the *Systema Naturæ* furnishes an unobjectionable starting-point, beyond which investigation need only extend from motives of curiosity; and is on several accounts more eligible than the date of the twelfth edition.

Mœhring, a mononomial author whose work appeared in 1752, has very frequently been quoted as authoritative, notably, among European authors, by Gray, and among American by Cassin, Baird, Bryant and others, including the present writer. Five genera of *Alcidæ* are instituted in this work of Mœhring's: (1) *Chenalopez*, based on *Alca impennis*; (2) *Spheniscus*, upon *Fratercula arctica*; (3) *Arctica*, upon *Mergulus alle*; (4) *Vria* (sc. *Uria*), upon *U. grylle*; and (5) *Cataractes*, upon *Lomvia troile*. Of these five, *Arctica* and *Cataractes* have never come into use, except in an isolated instance or two; *Uria* is in universal employ, accredited, however, as it should be, to a later writer; *Spheniscus* is used, in an entirely different acceptation, for a genus of Penguins; and *Chenalopez* for an Anserine genus. These names, though all positively identified, will not be countenanced in their Mœhringian acceptation, for reasons just mentioned.

(1758.) LINNÆUS, *Syst. Nat.*, ed. x.—The Linnæan genus *Alca* at this date comprehended six species, to wit: *impennis*, *torda*, "pica," *arctica*, *lomvia*, *alle*. Two Guillemots—*grylle* and *troile*—are presented under the genus *Colymbus*. Excluding from these eight species *Alca* "pica," which is the winter plumage of *torda*, we have at the outset of authoritative records seven Linnæan names, 1868.]

for as many valid species, representing as many distinct genera. The twelfth edition (of 1766) gives us nothing new.

(1760.) BRISSON, *Ornithologia*.—This author gives excellent descriptions of the then known species, but adds no new valid ones, though several stages of plumage are characterized under distinctive names. He was a polynomialist—to our lasting regret, and his great misfortune—and therefore not authoritative in the matter of species. With those, however, who quote him for genera, his *Fratercula* will stand as the name of the genus of which *Alca arctica* Linn. is the type; and his *Uria* for that one typified by *Uria grylle*.

(1764.) BRÜNNICH, *Ornithologia Borealis*.—This author was a strict binomialist; the question of the adoption of his names only hinges upon the acceptance of Linnæus at 1758 or at 1766. Brünnich's names are in general employ, as they should be. The chief point of this work, regarding the Auks, is the characterization of *Uria ringvia*, which, though known long before, had been usually referred to *troile*. Brünnich describes the young or winter plumage of *Utamania torda* under the names "unisulcata" and "balthica;" the young *Fratercula arctica* as "Alca deleta;" the albino *Mergulus alle* as "Alca candida;" various plumages of *Uria grylle* as "grylloides," "balthica," and — (No. 116). Brünnich's "Uria lomvia" is *Colymbus troille* Linn.; his "Uria troille" and "Uria svarbag" are both *Alca lomvia* Linn.; his "Uria alga" is *ringvia* Brünn. in winter plumage. His descriptions, though brief, are all recognizable. (Species now eight.)

(1769.) PALLAS, *Spicilegia Zoologica*, fasc. v.—Among the writers of the 18th century, no one contributed so much to a knowledge of the *Alcidæ* as Dr. Pallas. He introduced more new valid species than any other writer, and gave us our first knowledge of some of the curious forms from the North Pacific. His works claim the high eulogium, that every one of the species they contain are identifiable from the descriptions, and that a species is very rarely twice described as new. In the *Spicilegia* four species are for the first time described: *Alca cirrhata*, *A. psittacula*, *A. cristatella* and *A. tetracula*. A white state of plumage of *Uria grylle* (or possibly of *U. columba*) is described as "Cephus lacteolus." The four species above mentioned are well described, and illustrated by plates. (Species now twelve.)

(1785.) PENNANT, *Arctic Zoology*.—Although the author used only vernacular names, his work must be here considered, since in it four species are for the first time presented. These are the "Antient Auk" (for which the author is indebted to Dr. Pallas' MS.), the "Labrador Auk," the "Pigmy Auk," and the "Marbled Guillemot." The second and third of these are very dubious species, which have never been located to the entire satisfaction of ornithologists (cf. *infra*, under head of *Fratercula arctica* and *Simorhynchus pusillus*); the first and fourth are good species. In this work the future *Uria columba* is hinted at, but not named. (Species now fourteen.)

(1788.) GMELIN, *Systema Naturæ*.—In this compilation by the professional plagiarist nothing new is given, but some points require notice. The genera *Alca* and *Colymbus* retain, in general, their Linnæan signification. Pennant's four species, above noticed, appear in proper Latin garb, as *Alca antiqua*, *A. labradorica*, *A. pygmæa* and *Colymbus marmoratus*; Pallas' four species are continued. "Cephus lacteolus" Pallas re-appears as "Colymbus lacteolus." Linnæus' "Colymbus" *troille* is repeated, of course; but the other two species of Murre, though having already made their début, are discontinued, unless one of them is intended by a certain "Colymbus minor" Gm., for which Brünnich's Nos. 110, 111, are cited. *Alca* "pica" and *A.* "balthica" are perpetuated. (No additions; species still fourteen.)

(1790.) LATHAM, *Index Ornithologicus*.—This is the one of Dr. Latham's several works in which species are binomialized, and it is therefore the authoritative one. Except in adopting *Uria* (after Brisson), the Index is nearly a repeti-

[Jan.

tion of Gmelin. We have nothing new, except the first unequivocal indication of *Uria columba* in Latham's "*Uria grylle* Var. B. from Aonalaaschka" ("fascia alarum gemina alba," which was "*grylle* Var. A." of Latham's Synopsis, vol. iii.) "*Alca candida*" Brünn. and "*Cepphus lacteolus*" Pallas—both of which are merely albinos—still hold their ground; but the nominal species based upon the plumages of *Ulamania torda*, hitherto rampant, subside into "varieties." (Species still fourteen.)

(1790.) BONNATERRE, *Encyclopedie Methodique, Orn.*—Genus *Pinguinus* instituted, with *Alca impennis* L. as type. A certain "*Uria nivea*" is named, for which the author quotes Pallas, Spec. Zool. v. p. 33 ("lacteolus"; = albino *grylle* or *columba*).

(1794.) DONNDORFF (JOHANN AUGUST), *Beyträge Zoologische*, zweyter band, erster theil.—The great synonymist of the eighteenth century, as he fairly deserves to be called, gives no descriptions, but laboriously collates astonishing lists of synonyms. In the cases of some well-known birds, the citations stretch over several pages, giving one such an idea of the extent of the ornithological literature of the last century as could hardly be gained from any other work. Donndorff follows Linnæus in his reference of the Auks to two genera, *Alca* and *Colymbus*; the now sub-family *Urinæ* composing his "*Colymbi mit dreyzehigen Füssen*," as distinguished from the four-toed Divers proper. With this author *Alca* "*pica*" and "*balthica*" revive; *A.* "*labradorica*" and *A.* "*pygmæa*" continue in their original significance; Pallas' four species remain, and also his nominal species "*lacteolus*;" five varieties of *grylle* are enumerated, of which Var. "*B*" is *columba*. By the names "*Colymbus minor*" and "*troile*" the author probably intends to distinguish two species of Murre, but his synonyms are inextricably confused. The var. "*γ*" of *troile* is, however, unmistakably *r. ngvia* of Brünn.

Such was the general status of Alcidine literature as it came from the hands of the writers of the eighteenth century. We have fourteen well-known valid species, and indications of the fifteenth (*Uria columba*).

(1801.) LEPECHIN, *Nova Acta Petrop.* xii.—*Alca camtschatica* described. (Species now fifteen.)

(1811.) PALLAS, *Zoographia Rosso-Asiatica*.—Dr. Pallas for the second time comes forward to take a long step in advance of his contemporaries, with numerous new species from the North Pacific, and with a more extensive subdivision of the family. Six valid new species are described: to wit, "*Cepphus*" *columba*, "*Cepphus*" *carbo*, "*Alca*" *monocera*, "*Uria*" *aleutica*, "*Uria*" *dubia*, and "*Uria*" *pusilla*. Four known species are re-named: the Antient Auk being called "*Uria senicula*," the Camtschatkan Auk "*Uria mystacea*," the thick-billed Guillemot "*Cepphus arra*," and the marbled Guillemot "*Cepphus perdix*." "*Cepphus lomvia*," Pallas, equals "*Uria lomvia*," Brünnich, equals "*Colymbus*" *troile*, Linnæus. As in 1769, Dr. Pallas calls the Guillemots all "*Cepphus*;" all the other Auks are consigned to "*Uria*" except the Puffins, for which the generic name "*Lunda*" (after Gesner) is employed. *Alca psittacula* is ranged in this genus. (Species now twenty-one.)

(1811.) ILLIGER, *Prodromus*.—Genus *Mormon* instituted for the Puffins.

(1816.) VIEILLLOT, *Analyse*.—Genus *Mergulus* (after Ray) adopted for *Alca alle* Linn. Genus *Larva* instituted for the Puffins. Genus *Alca* "Linn." adopted for *cristatella*.

(1818.) *Transactions of the Linnæan Society*, xii.—Sabine re-names the thick-billed Guillemot, as "*Uria Brünnichii*;" Leach, a few pages further on, bestows another name on the same bird,—"*Uria Francsii*."

(1819.) MERREM.—Genus *Simorhynchus* instituted, with *Alca cristatella* Pallas, as type. (Fide G. R. Gray.)

1868.]

(1820.) TEMMINCK, *Man. Orn.*, ii.—Genus *Phaleris* instituted, with *psittacula* Pall. as type; containing this species and *cristatella* Pall.

(1821.) NAUMANN, *Isis*, p. 779, pl. 7.—The three known species of *Fratercula* ("Mormon," Ill.) are reviewed, with figures of the heads. A fourth species, *Mormon corniculatum*, is added. (Species now twenty-two.)

(1823.) LICHTENSTEIN, *Verzeichniss*, etc.—Alca *camtschatica* Lepechen is re-named "Mormon superciliosum." A certain "*Uria Mandtii*" is established, which is frequently quoted as a synonym of *Uria columba*, but appears to be rather an imperfect state of plumage of *grylle*.

(1824–5.) STEPHENS, *Continuation of Shaw's Gen. Zool.*, xii., xiii.—The species of the sub-family *Urinæ* are all included in the genus *Uria*; the type of the genus—*grylle*—is re-named "scapularis." *Phaleris* Temm. is adopted for the Starikis, comprehending *psittacula*, *tetracula*, *cristatella* and "pygmæa," the latter being the same as Gmelin's species of that name. *Fratercula* Briss. is adopted for the Puffins, though *Synthliboramphus antiquus* is included in the same genus. *F. glacialis* Leach appears.* Ray's specific name for *Mergulus alle*—*melanoleucus*—is adopted. *Utaania* n. g.,† based upon *A. torda*, is instituted; *Alca "pica"* is also ranged under it as a valid species,—making its last appearance upon the ornithological stage. (Species now twenty-three.)

(1827.) BONAPARTE, *Zoological Journal*, iii.—Alca *monocerata* Pall., re-described as "*Phaleris cerorhynca*."

(1828.) BONAPARTE, *Syn. Birds U. S. in Ann. Lyc. Nat. Hist. N. Y.* ii.—Alca *monocerata* Pall. re-described as "*Cerorhinca occidentalis*." In a foot note, under head of "*Phaleris cristatella* Temm.," Bonaparte quotes: "*Alca cristatella* et pygmæa, crested or flat-billed Auk, Lath. syn. iii. pl. 95, fig. 4. *Phaleris cristatella* Pl. Color. No. 200.‡ *Alca cristatella* Vieill. Gal. Ois. p. 297." (1)

(1828.) VIGORS, *Zoological Journal*, iv.—"*Uria brevirostris*" named. This is undoubtedly the young of a previously known species of *Brachyrhamphus*, but has never been positively identified. It is usually regarded as the young *B. marmoratus*.

(1829.) ESCHSCHOLTZ, *Zoological Atlas*.—Genus *Chimerina* instituted upon Alca *monocerata*, Pall., and the species called "*Chimerina cornuta*." Genus *Ombria* instituted upon Alca *psittacula*, Pall., upon which Temminck had previously based his *Phaleris*.

(1829.) KAUP. ———.—Genus *Cyclorhynchus* instituted upon Alca *psittacula* Pall. (Fide G. R. Gray.)

(— ?) TEMMINCK, *Planches Coloriées*. (No. 579).—"Uria" *Wurmizusume* described and figured. (Species now twenty-four.)

(1837.) BRANDT, *Bull. Sc. Acad. Imper. St. Petersburg*, ii.—During the time between the close of Dr. Pallas' labors and the appearance of Prof. Brandt's paper, there was a great deal of subdividing and re-arranging of the *Alcidae*, and much sawing of the air in a variety of ways; but, beyond the addition of three species, nothing new or specially noteworthy was put forth. Prof. Brandt originates a new classification of the Auks, (the first one which lays claim to any truly scientific character), institutes several new genera, and describes four new species, besides re-naming some others.

The Auks are primarily divided into two "tribes," called "Pterorhines" and "Gymnorhines." Under the former are ranged the true Auks, the Guillemots, and the Sea-dove; the latter comprehends all the rest of the family. The character is found in the feathering or nakedness of the nostrils. This scheme is spoken of more at length further on, and therefore need not be here criticised.

* This species must have been previously named elsewhere, since Naumann has it in the *Isis* in 1821; perhaps in the *Trans. Linn. Soc.* of 1818, or thereabouts.

† Named in 1816.

‡ Pl. Color. No. 200 represents *camtschatica* Lepechin, not *cristatella* Pallas.

The new genera are numerous. Of these *Brachyrhamphus*, (type *marmoratus*), *Lomvia*, (type *troile*), *Synthliboramphus*, (type *antiquus*), and *Ptychoramphus*, (type *aleuticus*), are all valid, and were much needed. On the contrary, *Tylorhamphus*, (type *cratellus*), *Ceratoblepharum*, (type *arctica*), and *Gymnoblepharum*, (type *cirrhatum*), were not called for, being antedated respectively by *Simorhynchus* Merrem, (1819), *Fratercula* Brisson, (1760), and *Lunda* Pallas, (1811.)

The founding of a subgenus, *Apobapton*, upon the type of *Brachyrhamphus*, is out of order. In the choice of names for the two subdivisions of *Uria* the author is unfortunate in taking the specific designation of the types of these genera, particularly in the case of *Lomvia*, which must stand for the genus of which *troile* is typical, necessitating a change in the specific appellation of one species of that genus, whose synonymy was already overburdened.

The four new species are *Phaleris microceros*, *Brachyrhamphus Wrangellii*, *B. brachypterus*, and *B. Kittlitzii*. Of the three last, *Wrangellii* is only to-day identified; the other two remain unknown, except by Brandt's description. *Brachypterus* is said to have the tarsi longer than the middle toe, which distinguishes it from all the known species of the genus. *Kittlitzii* is evidently a young bird, and probably not a valid species. It is very near *Uria brevirostris*, Vigors, if not the same, and may be the young either of *marmoratus* or *Wrangellii*. The present monograph does not recognize it as valid, leaving only three really new species to be attributed to Brandt's paper.

Brandt identifies and retains *Uria dubia* Pall. under name of *Phaleris dubius*; *Alca pygmæa* Gm. as *Uria pusilla* Pall., under name of *Phaleris pygmæa*. *Uria Wurmizusume* Temm., Pl. Color. 579, is renamed *Brachyrhamphus* (*Synthliboramphus*) *Temminckii*. *Alca monocerata* Pall. is renamed *Cerorhina* "orientalis," probably through a lapsus calami for *occidentalis* Bp. (Species now twenty-seven.)

(1836.) BONAPARTE, *Geographical and Comparative List*.—*Phaleris microceros* Brandt is renamed as *Phaleris* "nodi-rostra."

(1839.) VIGORS, *Zool. Voy. Blossom*.—*Alca antiqua* Gm. is renamed as "*Mergulus cirrhocephalus*."

(1839.) AUDUBON, *Orn. Biog.* v.—*Colymbus marmoratus* Gm. is renamed "*Uria Townsendii*." Audubon's figure of the supposed adult bird may be really *Brachyrhamphus Wrangellii* Brandt. His figure of the supposed young is really the adult *B. marmoratus*.

(1845.) GAMBEL, *Proc. Acad. Nat. Sc. Phila.*—*Uria aleutica* Pall. is renamed as "*Mergulus Cassinii*."

(1849.) GRAY and MITCHELL, *Genera of Birds*, iii.—A great blemish is the inclusion of the Penguins as a subfamily of the *Alcidae*, coming in between the *Starikis* and the *Murres*. Otherwise the arrangement here adopted of the *Alcidae* is as faultless as any ever proposed. Three subfamilies are recognized: *Alcinæ* for the true Auks and the Puffins; *Phaleridinae* for the *Starikis*; and *Urinæ*, for the Guillemots. (This arrangement is noticed further on in connection with Prof. Brandt's paper, under head of the general characters of the family). *Fratercula* Briss. is adopted for the Puffins; *Phaleris* Temm. for all the *Starikis*, except *Alca monocerata* Pall., for which *Cerorhina* Bp. is used; *Brachyrhamphus* Brandt, in the same acceptance as used by its founder; *Uria* Briss. for the Guillemots; and *Arctica* Moehring, for the Sea-doves. Under the head of the latter, besides *alle*, are ranged *cirrocephalus*, Vigors, and *Cassinii*, Gambel, with the exception of which, the lists of species are very accurate and very full. *Alca pygmæa* Gmel. is identified with *Uria pusilla* Pallas; *Uria Mandtii* Licht. is used for *Cephus columba* Pallas.

(1851.) BONAPARTE, *Proc. Zool. Soc. London*.—A new genus and species described—*Sagmatorrhina Lathamii*, with which *Alca labradoria* Gm. is identified. (Species now twenty-eight.)

(1856.) BONAPARTE, *Comptes Rendus*, xlii.—That portion of the Tableau 1868.]

Comparatif des Pelagiens which regards the Auks represents very nearly the classification now most in vogue, founded by Mr. G. R. Gray. The family is divided into three subfamilies—*Alcinæ*, embracing only two species; *Phaleridinae*, comprising all the Starikis; and *Urinæ*, including the Guillemots. It is thus the same as Gray's arrangement, except in excluding the Penguins; but in its minor details it is unique in several features. The genus *Pinguinus*, Bonaparte, is adopted, and *Alca* left for *Lorda*. *Simorhynchus*, Merrem, is taken for its type, (*cristatellus*) and *Phaleris*, Temminck, for its type, (*psittacula*;) the other small Phaleridines are ranged under *Tylorhamphus* Brandt, except *microceros*, which is put under *Ciceronia*, Reichenbach. *Uria* is subdivided into *Lomvia* Brandt for the larger species, and "Cephus" Pallas for the smaller ones. Most of these points are tenable, but some are not. Some very obvious improprieties are evident in the handling of the species. Thus Bonaparte insists on retaining "occidentalis" and "nodi-rostra," two names of his own that he knew were antedated, one by *monocerata* Pallas, and the other by *microceros*, Brandt. *Uria columba* is ranged as a synonym of *grylle*, while *Mandtii* is allowed to take its place. The *Uria* "unicolor" Benicken, which, according to the best authority, is only a state of plumage of *grylle*, is given as a valid species, and referred to a different subgenus. In this paper, as in others written towards the close of the life of the great ornithologist, may be discerned an inclination to lead opinion by the mere weight of a name, or force of personal authority.

(1858.) CASSIN, in *Baird's Birds of North America*.—Bonaparte's article just spoken of is made the basis, in a general way, of Mr. Cassin's paper, but with some important modifications. Only two subfamilies are admitted, *Alcinæ* and *Urinæ*, the former comprehending the Auks proper and the Starikis. *Chenalopez* Moehring is used as a subgeneric appellation for *Alca impennis*. *Mormon* Illiger is used for the Puffins, with *Lunda* Pall. and *Fratercula* Briss. as subgeneric divisions. *Phaleris* Temm. is employed generically for the majority of the Phaleridine forms, with *Simorhynchus* Merrem, *Tylorhamphus* Brandt, and *Ciceronia* Reichenbach, as subgeneric divisions. The erroneous assignment of *Tylorhamphus* is the same as that made by Bonaparte. The forms not included under *Phaleris* are each given independent generic rank. A new species of *Cerorhina* is described—*C. Suckleyi*—for a discussion of which the reader is referred further on. Among the *Urinæ*, the genus *Uria* Moehring is subdivided, after Keyserling and Blasius, into two subgenera—*Uria* proper and *Cataractes* Moehring. *Brachyrhamphus* Brandt is adopted for the Murrelets,* with *Apobapton* Brandt as a subgenus.

This article treats of all the known species of the family, and is, in fact, a monograph of the subject, at once very accurate, and, as far as it goes, complete. Excellent descriptions, in most cases original, are given, together with many synonyms, lists of specimens in the museum of the Smithsonian Institution and Philadelphia Academy, and critical and explanatory remarks. Although the present writer does not endorse all of the opinions maintained in this article, he considers it as by far the best that has ever appeared in print. (Species now twenty-nine.)

(1859.) XANTUS, *Proc. Acad. Nat. Sc. Phila.*—*Brachyrhamphus hypoleucus*, a new species, described. (Species now thirty.)

(1861.) BRYANT, *Proc. Bost. Soc. Nat. Hist.*—"A monograph of the genus *Cataractes* Moehring," with full lists of synonyms, and very accurate descriptions. The family is named "Plautidæ" after Klein. The genus is considered in its restricted sense, including only *troile* Linn., *ringvia* Brünn., and *lomvia* Linn., to which a new species, *C. Californicus*, is added. This is a very valuable contribution. (Species now thirty-one.)

* The present writer proposes this English name for the species of *Brachyrhamphus*.

(1862.) NEWTON, *Ibis*, Oct. From among the many contributions to the Natural History of the Great Auk, this admirable paper is selected for special mention, both as embodying about all that was known upon the subject previous to its publication, and as containing the results of the diligent and careful researches of the author and Mr. J. Wolley, in Iceland. It is probably the best article upon the subject extant; to which the reader may refer in full confidence that he will find an epitome of our present knowledge. Mr. Newton is of opinion that the Great Auk may still live. He attributes the extinction to which it is surely doomed, mainly to direct human interference. The paper is again referred to, and quoted, in the present memoir.

(1867.) SCHLEGEL, *Catalogue of the Museum of the Pays-Bas*, livraison ix. The article "Alca" is in one sense nearly a monograph of the subject, since the greater part of the species of the family are represented in the Museum of the Pays-Bas, and therefore admitted as valid by the author. Unfortunately, however, the author's ultra-conservatism, on matters specific as well as generic, does not allow him to keep pace with the progress of science, and as a consequence, his system of nomenclature and classification is simply curious. One seeks in vain to divine the reason for the maintenance and expression of such peculiar views, unless it be the author's intention to administer a sort of counter-irritant as a remedy against Brehmomania, or to launch a severe satire against the "furor genericus," and other crying evils of the day. Such extreme views, if discreetly indulged for either of the charitable purposes just suggested, are perhaps excusable; the only question is, whether the remedy is not worse than the disease.

Aside from its value as a Museum Catalogue, the present article is chiefly useful for its accurate indications of different stages of plumage, of differences in dimensions of variable species, and as affording some interesting data in the way of locality. The "genus Alca" is made to hold all the *Alcinæ* and all the *Urinæ*. The Starikis appear under the genus *Simorhynchus*; the Puffins under *Lunda*. It is impossible to subject this arrangement to criticism, since in it there is nothing approaching a classification, and arbitrary illogical opinion is not to be brought under critical review. The common Guillemot appears as "*Alca lomvia*," though no point of synonymy is more incontestible than that its proper specific name is *troile*. *Ringvia* is considered as a variety of the same. *Uria columba* is not regarded as valid, apparently because the wing-patch of *Uria grylle* is well known to vary in its characters. *Alca pygmæa* Gm., *Uria pusilla* Pall. and *Phaleris microceros* are thrown together under the common name of "*Simorhynchus pygmæus*." *Alca tetracula* Pall., and *Uria dubia* Pall., are both regarded as the young of *cratatellus*. *Sagmatorrhina Lathamii*, Bonaparte, and *Cerorhina Suckleyi*, Cassin, are both referred to *Alca monocerata*, Pallas. *Mormon glacialis* Leach is not recognized. The *Brachyrhamphi* are not included; but the highly characteristic remark occurs, (p. 21) "Il convient d'étudier de rechef les oiseaux décrits sous les épithètes de Kittlitzii, Wrangeli et brachyptera, et même l'*Alca marmorata*!"

(1867.) SALVADORI, *Descr. Alt. Nuov. Ucc. Mus. di Torino*.—*Uria Craveri* described. This a new *Brachyrhamphus* from California, closely allied to *B. hypoleucus*. (Species now thirty-two.)

Of the thirty-two species noted in the preceding paragraphs, and held to be valid, twenty-eight are contained in the various American collections to which the writer has had access, and are in the present paper identified and described directly from the specimens themselves. The four species not examined are: "*Uria*" *dubia* Pallas; *Brachyrhamphus brachypterus* Brandt; *Sagmatorrhina Lathamii* Bonaparte; and "*Uria*" *Craveri* Salvadori. Of the two last the writer has received some information through private channels, beyond that contained in the published papers; of the two first he knows nothing, except from the original descriptions.

1868.]

A new and very curious species of *Simorhynchus* is described in the following pages, making a total of thirty-three.

II. Of the characters of the Family, and its sub-divisions.

The Auks form a very natural family of birds, distinguished by marked and unmistakable characters from any other. With a single exception,* there is no bird found to present in any notable degree a leaning towards the peculiarities of the *Alcidæ*; and the members of the family, without exception, preserve intact those characters which define the group so trenchantly, showing in no single instance a tendency to aberration. The rigidity with which it is possible to circumscribe the *Alcidæ* is in the highest degree satisfactory, in a class of animals in which the recognition and definition of subordinate groups is peculiarly difficult.

The natural place of the family in our ornithotaxis appears as definite as the characters which separate its forms from other birds. By common consent, the *Alcidæ* are regarded as next to the lowest of birds. The degradation of the type or ideal bird which the Auks represent is only carried further in one family—the *Spheniscidæ*. From the latter, which is at the bottom of the scale, we ascend one step to *Alcidæ*; another brings us to the *Colymbidæ* and *Podicipidæ*. These four families constitute the order *Pygopodes*, or the Brachypterous Natatores. The position occupied by the Auks in this order is so evident as not to admit of question.

It is only necessary to allude to the wings of the *Spheniscidæ*, without dwelling upon the point, to separate this family from the Auks. The tetradactylous feet of the other two families distinguish them with equal facility. Auks are brachypterous, brachyurous, tridactylous natatores, with lateral nostrils. This expression is a perfect diagnosis.

The Auks are confined to the northern hemisphere. Some representatives have been found as far north as explorers have penetrated. The great majority live in more temperate latitudes. A more or less complete migration takes place with most species, which stray southward, sometimes to a considerable distance, in the autumn, and return north again to breed in the spring. A few species appear nearly stationary. The most southern recorded habitat of any member of the family is about latitude 21° N., on the Pacific coast of North America, but this is rather exceptional. The species are very unequally divided between the two oceans. The Atlantic has but few representatives compared with the Pacific. On the northern coasts of the latter the family reaches its highest development; the greatest number of species, of the most diversified forms, are found there, though the number of individuals of any species does not surpass that of several Atlantic species. Comparatively few species are common to both oceans. All the members of the family are exclusively marine.† They are decidedly gregarious, particularly in the breeding season, when some species congregate in countless numbers. Usually one, often two, rarely if ever three eggs are laid, either upon the bare rock or ground, or in crevices between or under rocks, or in burrows excavated for the purpose. Auks are all altrices, and are believed to be chiefly monogamous. The young are at first covered with long soft woolly down; rarely stiffish hairs appear on some parts. The moult is double. The young of the year usually differ from the adults; the latter usually differ in their summer and winter plumages. A very prevalent feature is the possession of crests or plumes, or elongated feathers of a peculiar shape on the sides of the head. All the species walk badly; some scarcely walk at all. The position of the legs with reference to the axis of the body necessitates an upright position when standing. The birds appear to rest on their rumps, with the feet extended horizontally before them, most

* The genus *Pelecanoides*, of the *Halodrominæ* (*Procellariidæ*), in all details of external form, except those of the bill, is essentially like *Mergulus*.

† *Uria grylle* is found on the southern shores of Hudson's Bay; but this fact can hardly furnish an exception to the statement.

of the tarsus touching the ground. The Puffins, however, and a few others, stand well on their feet. All the species but one, fly well, with rapid vigorous motion of the wings, in a straight, firm, well-sustained course. All progress on or under the water with the utmost facility. They are very silent birds; the voice is rough and harsh; the notes are monotoned. They feed exclusively upon animal substances procured from the water.

The uniformity of structure which obtains throughout the family has already been mentioned; the following paragraphs describe this structure in a general way, so far as the details of external form are concerned:*

The general form is stout, compact and heavy. The body is depressed, flattened underneath. The neck is short and thick. The head is large and heavy, usually oval in shape, more or less flattened laterally, more or less drawn out anteriorly, and sloping gradually on all sides to the bill, but sometimes ending abruptly. The plumage about the head is very soft, dense, and short, except those feathers which constitute the peculiar crest or lateral plumes already mentioned. That of the upper parts is very closely imbricated; that of the lower is very thick, compact, elastic, and otherwise eminently fitted to resist the action of water.†

The bill, though constantly preserving certain characteristics, varies to a remarkable degree in the details of its shape. The broad statement may be made, that no two species‡ of the family have bills identical in shape. So unending is the variation in the bill, that in some cases great differences in shape seem of scarcely more than specific consequence, as is especially the case in the genus *Simorhynchus*. The bill in the great majority of species is more or less compressed, sometimes excessively so; it is frequently, however, nearly as wide as high at the base, and more or less subulate. The contour of the bill in many instances deviates from an ordinary standard so much that the shape may almost be called monstrous. A striking peculiarity of the bill in several genera is the presence of supernumerary elements or accessory pieces, taking the form of salient protuberances. These are usually developed on the culmen; in one instance on the gonys; in one at the angle of the rictus; in several along the feathered base of the bill. Besides these appendages, there are often found grooves and ridges on the sides of one or both mandibles. The culmen is always more or less convex; in one instance it is bi-convex. The tomial edges of the mandibles are more or less sinuate; sometimes nearly straight; usually decurved at the tip, and slightly notched; in one instance recurved. The rictus is ample.§ The mandibular rami approach each other with a very narrow angle, and soon join, producing a long gonys, which is usually nearly straight. One genus has a very convex gonys; in two others the gonys runs the whole length of the bill, there being no mandibular rami proper. The bill is entirely horny, except in two species, in which a soft membrane overlaps the base of the upper mandible; and in a third, where a peculiar knob is not strictly corneous.

The nostrils are basal, lateral, marginal, impervious; usually linear, or narrowly oval; in a few instances placed further from the commissural edge of the upper mandible, and nearly circular. The nasal fossæ are usually very evident; are sometimes hidden by feathers; at others are wholly wanting. The extension of the feathers into the nasal fossæ varies in degree, when it occurs. In just about half the species the nostrils are naked; these usually have no true nasal fossæ. In the other half fossæ occur; entirely obstructed by feathers in three genera; partially covered in the rest. The significance of these features will receive further attention below.

* The writer hopes to bring forward, at some future time, a memoir on the anatomy of the family.

† Cf. Nitzsch's Pterylography for pterylosis of *Ulamania torda*.

‡ Is *Uria ringia* specifically distinct from *U. troile*?

§ In two genera, in which the excessive compression of the bill produces a very constricted rictus, its amplification is provided for by means of a dilatable skin at the angle of the mouth.

The wings are short. In no instance do they, when folded, reach to the end of the tail. In one species they are so undeveloped in their terminal segments* that the power of flight is abrogated. The first primary is always longest; the rest rapidly and regularly graduated; all taper to a sufficiently fine point. The secondaries are very short, and broadly rounded. The primary coverts are very long, reaching much more than half-way from the carpus to the end of the first primary. The first row of secondary coverts reach nearly to the end of the secondaries. The under wing coverts are very long. The axillars are short or wanting. The wing as a whole is convex above, concave below, narrow, sharp, stiff, somewhat falcate. These points of structure are constant throughout the family.

The tail is very short; its length is contained, on an average, about three times in the length of wing from the carpal joint. It is usually slightly rounded, sometimes nearly square, in a few instances pointed; in a few more the central rectrices are slightly shorter than the next pair. The individual feathers are usually very obtuse at the end. Both sets of coverts are long; the inferior usually reach nearly or quite to the end of the tail.

The feet are small, and placed far back, as has been said. The thighs are contained within the general skin of the body. The legs are feathered nearly or quite to the tibio-tarsal joint. The tarsus is short, sometimes excessively abbreviated, rarely equal to the middle toe without its claw, never (†) longer. It is usually much compressed, is sometimes almost as sharp as that of *Colymbus*, is frequently nearly as broad laterally as antero-posteriorly. Its covering varies with different genera. It is usually reticulate behind and laterally, with a row of scutellæ in front, which rarely, however, if ever, extend its whole length. In some genera it is entirely reticulate; in others, the scutellation extends on one or both sides. The tarsal envelope varies so much that it is not available as a character for subdivisions higher than generic. The toes are very long; the outer and middle always of nearly the same length; the inner shorter, its claw just reaching the base of the middle claw. There is no hind toe. Dissection reveals the rudiment of a hallux, which, however, is never developed sufficiently to make even a well-marked prominence. The webbing of the toes is complete. The claws are all moderately arched, compressed and acute; the inner edge of the middle is more or less dilated; the middle is always the largest, except in two genera, which present the peculiarity of having a very large semi-circular inner lateral claw, which, moreover, lies horizontally instead of vertically.

That rigid adherence to the type of structure just described which all the species maintain, while facilitating the recognition of the family as a family, is a serious obstacle in the way of defining its subdivisions with precision. With no very abrupt transition from one form to another, and without any very marked modification of general features, the minor groups seem to be formed mainly by the varying combination of the few differences in structure which obtain in the family. The assemblage of characters, rather than the presence or absence of particular features, in most cases determines the genera; and no two species are absolutely alike in all points of form.

—“Facies non omnibus una.

Nec diversa tamen, qualis decet esse sororum.”

In one of the ablest papers that has appeared upon this subject, Professor Brandt divides the *Alcidæ* into two subfamilies: those with feathered, and those with naked nostrils. In this arrangement the Guillemots stand next to the typical Auk—*A. torda*. Viewed from any other standpoint the two forms

* Cf. Mr. A. Newton's article in the "Ibis" for October, 1862. As there stated, the humerus of *Alca impennis* is of normal size; the antibrachium, carpus and metacarpus, and their quills, are shortened.

† *Brachyrhamphus brachypterus* is said by Brandt to have the tarsus longer than the middle toe.

appear to represent the extremes of structure in the family; particularly in regard to the bill, cultriform in one, subulate in the other. The two types are by most authors placed at opposite ends of the generic chain, and separated by all the Starikis. Attentive consideration of all the bearings of the case may very likely result in the opinion, held by the present writer, that the difference between the views of Prof. Brandt and other writers is rather apparent than real. It should be borne in mind that the *Alcidae* are a family very rigidly circumscribed, and one showing no tendency to aberration, or to connect itself intimately with the families standing next to it on either side. Whether as cause or consequence of this, the fact is indisputable, that the genera of *Alcidae* are not strung along in a chain whose ends seem as it were to be linked with the genera of other families; they tend, on the contrary, to aggregation in a circle about a common centre. We may take any genus—it matters not which—we shall find its closest ally to the right and to the left; and the circuit shall be complete when all the genera have been considered. To illustrate this point: Prof. Brandt, like all other writers, takes the typical *Alca* as his starting point. With the feathering of the nostrils as a fundamental feature, *Uria* and its subdivisions must come next, then *Brachyrhamphus*; this leading through *Mergulus* into the true Phaleridines, by means of *Ptychoramphus*. Beginning with those Phaleridines with the simplest bills, he progresses to those with more complex bills, ending with *Ombria*, which last, through *Cerorhina*, conducts to *Fratercula*, which ends the series. There is nothing strained or forced in this; the succession of the genera is perfectly natural. But it so happens that *Fratercula* is as closely, or even more closely, allied to *Alca* proper than *Uria* is. We cannot disturb in any essential degree the generic series of Prof. Brandt, but we could with entire propriety go directly from *Alca* to *Fratercula*, and thence backwards over the same track, ending with *Uria*, which would then be at the opposite extreme of the series. It is asserted, without fear of reasonable contradiction, that to begin anywhere in this natural series of genera and progress through it, is to be brought back to the starting point.

It is not, perhaps, possible to divide this generic circle without the exercise of some arbitrary jurisdiction. If there be included in it two or more subfamilies capable of precise definition, the fact has eluded the writer's research. There are, however, in the series two places where a dividing line may be drawn. Prof. Brandt drew but one, relying upon the single character which he found to apply so well, albeit it may be an arbitrary one. Other writers have made likewise but two subfamilies, differently framed however; the *Alcinæ*, including the true Auks, together with the Phaleridine forms, united because of their short, stout, high bills; and the *Urinæ*, separated on the ground of their long, slender subulate bills. Others again, particularly Mr. G. R. Gray and Prince Bonaparte, have drawn two lines, recognizing three subfamilies; and this course appears to be the one that holds closest to nature, provided the family be really susceptible of subdivisions higher than generic. By simply reducing Prof. Brandt's fundamental character to the level of one drawn from the general structure of the bill, three subfamilies stand forth with tolerable distinctness. The *Alcinæ* have feathered nostrils and cultriform bills; the *Phaleridinae*, naked nostrils and cultriform bills; the *Urinæ*, feathered nostrils and subulate bills. This certainly appears to be a distinction with a difference, and will be so held in the present paper.

The arrangement of the *Alcidae* here submitted is a modification of Professor Brandt's, providing for the recognition of three in place of two subfamilies. In this particular it is substantially the same as Mr. Gray's, but the sequence of the genera is entirely different, and is nearly that of the first mentioned author. Beginning with typical *Alca* it passes to *Fratercula*, and ends with *Lomvia*, instead of passing to *Lomvia* and ending with *Fratercula*. But in either case the collocation of the genera is essentially the same. It is believed
1868.]

that this sequence of genera cannot be broken in upon to any considerable degree, without the rupture of a natural series as a consequence.

Family *ALCIDÆ*.

CH.—Tridactylous, brachypterous, brachyurous Natatores, with lateral nostrils.

A.—Subfamily *ALCINÆ*.—Not crested; with feathered nostrils; compressed cultriform bill, much higher than wide at base, without appendages, but grooved on the sides; tail pointed.

1. *Alca*.—Wings rudimental, not admitting of flight.

2. *Utaania*.—Wings fully developed, admitting of flight.

B.—Subfamily *PHALERIDINÆ*.—Usually crested, or with elongated feathers on head; with naked nostrils; bill variable, always compressed, higher than wide at the base, often with appendages; tail nearly even.

3. *Fratercula*.—Inner lateral claw very large, semi-circular, acute, horizontal; bill excessively thin, its base ridged, its culmen simple, with one curve; under mandible grooved; no crest; palpebral appendages; a furrow in plumage behind eyes; tarsi anteriorly scutellate.

4. *Lunda*.—As in *Fratercula*; culmen with an accessory piece, and two curves; under mandible smooth; long crests; no furrow in plumage; no palpebral appendages.

5. *Ceratorhyncha*.—Inner lateral claw normal; bill without a basal rim; base of upper mandible with a prominent upright horn; rami of lower mandible with an accessory piece; head with elongated feathers; tarsi anteriorly scutellate.

6. *Sagmatorrhina*.—Base of upper mandible overlapped by a soft membrane; no accessory piece on lower mandible; otherwise as in *Ceratorhyncha*.

7. *Simorhynchus*.—Bill variable, usually with irregular outline or with appendages; head with a crest or elongate feathers; tarsi reticulate.

8. *Ptychorhamphus*.—Bill stout, conico-elongate, wide at base, acute at tip; base of upper mandible with transverse striæ; upper border of nostrils dilated, flaring; no crests.

C.—Subfamily *URINÆ*.—Nostrils more or less completely feathered; bill elongated, more or less slender and subulate, without appendages or vertical grooves; head not crested, (except in one species.)

9. *Mergulus*.—Nostrils nearly circular, not completely feathered; bill stoutest and shortest in this section; tail much graduated; tarsi scarcely compressed, anteriorly broadly scutellate.

10. *Synthliborhamphus*.—Nostrils broadly oval, incompletely feathered; bill stoutish, but much compressed; tail nearly even; tarsi excessively compressed, anteriorly and internally scutellate.

11. *Brachyrhamphus*.—Nostrils oval, feathered; bill small, very slender; tail short, little graduated; tarsi reticulate, very small and slender, not compressed.

12. *Uria*.—Bill about equal to tarsus; gonys half the culmen; nasal fossæ wide and deep, not entirely filled with feathers; upper mandible with no groove at tip; outer lateral claw grooved; tail contained $2\frac{1}{2}$ times in the wing; tarsi reticulate; no furrow in plumage of head.

13. *Lomvia*.—Bill much longer than tarsus; gonys much more than half the culmen; nasal fossæ long and narrow, completely feathered; upper mandible with a groove at tip; outer lateral claw smooth; tail contained $3\frac{1}{2}$ times in wing; tarsi anteriorly scutellate; a furrow in plumage behind the eyes.

[Jan.

III.—Descriptions of Genera and Species.

1. Subfamily ALCINÆ.

ALCA, Linnæus.

Chenalopez, Mœhring, Av. Gen. 1752, p. 65, No. 68.

Alca, Linnæus, Syst. Nat. i. 1758; and of authors.

Pinguinus, Bonnaterre, Ency. Method. Orn. 1790, p. 28.

Size largest in the family. Form heavy, compact, robust. Head large, ovate, produced forwards. Neck moderately long, thick. Wings morphologically perfect, teleologically rudimental, not admitting of flight, in length from carpal joint to end of longest primary scarcely twice as long as tail; when folded not reaching the tail. Tail short, pointed. Legs short and stout. Webs broad and full. Tarsi compressed; their anterior ridge and superior surfaces of toes scutellate, lateral and posterior aspects reticulate, the plates on the latter very small. Tibiæ feathered nearly to the joint. Bill about as long as the head, large, strong, very deep, exceedingly compressed. Upper mandible with culmen about straight for half its length, then regularly convex, tip obtuse, declinate, scarcely overhanging; a deep groove on its side at base, parallel with the outline of feathers; its side then perfectly smooth for a space, then deeply impressed with six to ten oblique curved sulci. Gape very large, running far back; line of commissure nearly following that of culmen. Eminentia symphysis slight; gonyes nearly straight. Lower mandible two-thirds as deep as upper, its sides impressed with six to ten straight, vertical sulci. Feathers about base of mandibles short, very compact; extending downwards from base of culmen, a little forwards, to commissural edge of upper mandible; reaching much further on sides of lower mandible; wholly covering the moderately long, very narrowly linear, impervious nostrils, which are situated just above the commissure.

It is unnecessary to compare this genus with any other. *Utamania*, most closely allied, is at once distinguished by its teleologically perfect wings, though nearly identical with *Alca* in other points of structure. The only known representative of the genus is remarkable, both for its large size, and for not possessing the power of flight, in consequence of which it may be said to represent, in the Northern Hemisphere, the numerous Penguins of the Southern. By many ornithologists it is believed to have very recently become nearly or quite extinct.

Rigid adherence to the law of priority would necessitate the use of a different name for this genus. "*Alca*" was first applied by Linnæus, in 1744, to the genus of which the bird now called *Fratercula* or *Mormon arcticus* is typical; and even as used by Linnæus in 1758 it has *torda* as its recognized type, according to that rule which regards the species first mentioned as type, when none is otherwise indicated; so that it cannot, with strict propriety, be used at all in this connection. But the name has become so firmly established by common consent and long usage, that it would be ruthless, as well as profitless, to attempt its supercedure by *Chenalopez* of Mœhring, 1752; particularly as this latter word has come into extensive employ for an Anserine genus. The genus *Alca*, as framed by Linnæus in 1758, included both *torda* and *impennis*; and when restricted, by the generic separation of these two types, there seems no good reason why the first mentioned should be regarded as more peculiarly typical of the genus than the last. Should *Alca* be reserved for *Fratercula arctica*, or for *Utamania torda*, it will be apparent that numerous unwarrantable innovations necessarily follow; while its employ in connection with *impennis* entails no such consequences.

ALCA IMPENNIS Linn.

Chenalopez, Mœhring, Av. Gen. 1752, p. 65, No. 68. "Rostrum conoides, convexum, ad latera compressum, aliquot sulcis transuersis canalicula-
1868.]

tum," etc. Quotes *Anser magellanicus*, Clus. Worm. Raii, Will. Orn. 242, and *Alca species*, Linn. ed. vi, gen. 52.

Alca (Chenalopez) impennis, Cassin, Baird's B. N. A. 1858, p. 900.

Mergus americanus, "Charleston, Onom. Zoic. p. 96, No. 10." "Nieremb. Exot. lib. 10, c. 27," fide Donndorff. Not *Mergus americanus* Cassin, 1853.

Alca major, Brisson, Ornithologia, vi, 1760, p. 85, pl. 7.

Alca impennis, Linnæus, S. N. ed. x, 1758, p. 130, No. 2. Id. ibid. ed. xii, 1766, p. 210, No. 2. Quotes *Alca major* Briss. and *Mergus americanus* Clus. Exot. 103. Brünnich, Orn. Bor. 1764, p. 26, No. 105. Gmelin, S. N. 1788, i, pt. ii, p. 550, No. 3. Lath. Ind. Orn. ii, 1790, p. 791, No. 1. Donndorff, Beyträge Zoologische, ii, pt. i, 1794, p. 817. Sander, Grösse u. Schönh. Natur. i, p. 243. Hermann, Tab. Aff. Anim. p. 150. Temminck, Man. Orn. ii, 1820, p. 939. Stephens, Shaw's Gen. Zool. xiii, 1825, p. 51. Bonaparte, Synopsis, 1828, p. 432. Audubon, Orn. Biogr. 1838, iv, p. 316. Brandt, Bull. Acad. St. Petersb. ii, 1837, p. 345. Fleming, Hist. Brit. Anim. 1842, p. 129. Gray, Genera Birds, iii, 1849, p. 637. Thompson, Nat. Hist. Ireland, 1851, iii, p. 238. Macgillivray, Hist. Brit. Birds, 1852, ii, p. 359. Steenstrup, "Vidensk. Middell. for Aaret, 1855; Kjöbenhavn, 1856—57, pp. 33—116." Newton, Ibis, 1862, p. —, (Historical.) Schlegel, Urinatores Mus. Pays-Bas, livr. ix, 1867, p. 13.

Pinguinus impennis, Bonnaterra, Ency. Method. Orn. 1790, p. 29. Bonaparte, Conspectus. Gav. Comptes Rendus, 1856, p. 774.

Description (from the specimen in the Philada. Acad.)—The white spot between the eye and bill is ovate in shape, its upper border a little straightened, its small end towards, but not quite reaching, the bill, its large end extending to, but not around, the eye; the width of the black space between it and its fellow is rather more than half an inch. The back is dusky-black; other dark-colored parts with a good deal of clear brown, especially on the head. The under parts, including the tail coverts, are white, this color running far up on the front of the neck in a narrowly acute angle. The under wing coverts are ashy-gray. The secondaries are narrowly but distinctly tipped with white. The bill is deep black, its sulci dull white. The feet are dark, their precise color at present undefinable.

Dimensions.—"Length about 30 inches;" wing 5.75; tail about 3.00; bill along gape 4.25; chord of culmen 3.15; greatest width of bill .66; greatest depth of upper mandible 1.00, of lower .66; tarsus 1.66; middle toe and claw 3.25; outer 3.00; inner 2.25.

The occurrence of this species on the coast of North America has not been authenticated of late years. Perhaps the last instance on record is that given by Audubon on page 316 of the fourth volume of "Ornithological Biography." "The only authentic account of the occurrence of this bird on our coast that I possess, was obtained from Mr. Henry Havell, brother of my engraver, who, when on his passage from New York to England, booked a Great Auk on the banks of Newfoundland, in extremely boisterous weather." This specimen was not preserved. "When I was in Labrador," continues Audubon, "many of the fishermen assured me that the 'Penguin,' as they name this bird, breeds on a low rocky island to the south-east of Newfoundland." The present writer received similar assurances when in Labrador in 1860—the place designated being the "Funks." Audubon also states that "an old gunner residing on Chelsea Beach, near Boston, told me that he well remembered the time when the penguins were plentiful about Nahant and some other islands in the Bay."

Two specimens only are known to exist in any American museum. One is in the Philadelphia Academy; its history is uncertain. The other, in the Vassar College, at Poughkeepsie, N. Y., is the original of Audubon's plate and description, as stated in the following note from Prof. Sanborn Tenny, favored in reply to questions regarding it: "The Great Auk, presented to Vassar College by J. P. Giraud, Jr., Esq., is in a perfect state of preservation. This specimen is the one from which Audubon made his drawing, and it was presented

[Jan.

to Giraud by Audubon himself. Neither Giraud nor myself has further knowledge of it than what is contained in Audubon's works."

Concerning Mr. Audubon's specimen, Mr. Cassin remarks (B. N. A., p. 901), that it was "obtained by him (Mr. A.) on the banks of Newfoundland;" upon which statement Mr. A. Newton (Ibis, Oct., 1862) observes: "In 1857 I was assured by Mr. Bell, the well-known taxidermist at New York, who knew Mr. Audubon intimately, that he never possessed but one specimen of this bird; and if we turn to Prof. MacGillivray's 'History of British Birds' (vol. v. p. 359), we find him saying that he never saw but two examples of the species, one in the British Museum, and 'the other belonging to Mr. Audubon, and procured by him in London.'" This serves to throw some little light on the history of the specimen now in the Vassar College, Poughkeepsie, N. Y.

In the *Annals and Magazine of Natural History* for 1864, p. 235, is given, by Mr. Robert Champley, "a list of the present possessors of the birds, skeletons and eggs of the *Alca impennis*:" this gentleman being cognizant of the existence of twenty-seven skins, six skeletons, and fifty-three eggs. Dr. G. Hartlaub (Bericht üb. d. Leist. in d. Naturg. der Vögel for 1864) remarks upon this enumeration: "Es ist dieses Verzeichniss indessen sehr unvollständig. So z. B. geschicht des schönen Exemplares der Bremer Sammlung so wie des prachtvollen Ei's im Museum zu Oldenburg keine Erwähnung." Mr. A. Newton, on the subject of existing specimens, has (l. c.) the following: "If all the stories we received can be credited, the whole number would reach eighty-seven. I should imagine sixty to be about the real amount;" and again: "It is pretty evident that most of the specimens of the Great Auk and its eggs, which now exist in collections, were obtained from Eldey between the years 1830 and 1844.*"

Two eggs are contained in the Philadelphia Academy's collection.

Mr. Alfred Newton's paper in the "Ibis" for October, 1862, entitled "Abstract of Mr. J. Wolley's Researches in Iceland respecting the Gare-Fowl or Great Auk (*Alca impennis*, Linn.)," is exceedingly valuable, being one of the most complete and satisfactory histories of the bird ever published; and may be consulted with the greatest pleasure and profit. The writer is at special pains to correct the very prevalent erroneous impression, that the Great Auk is a bird of high latitudes. His researches warrant his belief that "the Gare-fowl has probably never once occurred within the arctic circle." Mr. Selby's statement (Brit. Orn., ii. p. 433) of its occurrence in Spitzbergen is shown to be unfounded; and notices of its occurrence in Northern Norway and in Greenland are proven to be not wholly worthy of confidence. Mr. Newton brings his extremely interesting history of the bird, as an inhabitant of Iceland, down to the year 1844, when the last birds known to have occurred were caught and killed; and as these may be regarded by some as the last of their race, he gives the particulars of their capture. Mr. Wolley and himself obtained many specimens of bones, but found no traces of the living birds, though he says: "I think there is yet a chance of the Great Auk still existing in Iceland."

UTAMANIA Leach.

Alca, Linnæus, Syst. Nat. 1758; and of most authors. Type *A. torda* L.

Diomedea, Scopoli, 1777, fide G. R. Gray. Not of authors.

Torda, Duméril, Zool. Anal. etc. 1806. Same type.

Utamania, Leach, "Syst. Cat. etc. 1816;" Steph. Cont. Shaw's Gen. Zool. xiii. 1825; and of many authors. Same type.

Size moderate; form stout, compact, heavy; head moderate, anteriorly produced, neck thick. Wings of moderate length, but fully developed, admitting

*—Lists of these, which are in the main correct, though I know of a few that are omitted, have lately appeared in the 'Zoologist' for the present year [1862], pp. 7363 and 7386, and almost simultaneously in the 'Field' newspaper (Nos. 423 and 424, pp. 93, 114). Further remarks on them will be found in the former Journal (pp. 7387 and 7433).—Newton, l. c.

of flight, reaching when folded beyond base of tail; more than twice as long as tail from carpal joint to end of longest primary. Tail rather short, pointed, of somewhat stiffened, acuminate feathers, of which the central pair are elongated and tapering. Legs short, stout; tibiae bare for a short space above joint; tarsi compressed, anteriorly with a single row of scutellæ, posteriorly and laterally finely reticulate, shorter than the middle toe. Toes long, outer nearly equal to middle, inner much shorter; interdigital membranes broad and full; claws short, stout, obtuse. Bill about as long as head, densely feathered for half its length; feathers on upper mandible extending beyond middle of commissure, nearly as far as those on lower mandible. Bill greatly compressed, its sides flat, with several transverse sulci, its culmen ridged, regularly convex; tip of upper mandible declinate, rather acute; its base encircled by a prominent ridge; gonys about straight; commissure straight to tip, then suddenly deflected. Nostrils just above cutting edge of bill, in its feathered portion, just posterior to basal ridge, impervious, narrowly linear.

Comprising a single species, upon the varying plumages of which numerous nominal species were established by the earlier authors. The employ of the present name for the genus, instead of *Alca* of Linnaeus, 1758, is perhaps defensible, upon the grounds alluded to; although the reason for the non-acceptance by authors of *Torda* of Duméril as a generic designation is not apparent. It would be easy to find, among the synonyms of the species, a trivial name to replace *Torda*, should it become necessary to use this as a patronym.

UTAMANIA TORDA, (L.) Leach.

Alca torda, Linnaeus, S. N. ed. x. 1758, i. p. 130, adult. Id. *ibid.* ed. xii. 1766, i. p. 210; adult. Brünnich, Orn. Bor. 1764, p. 25, No. 100; adult. Gmelin, S. N. i. pt. ii. 1788, p. 551. Latham, Ind. Orn. ii. 1790, p. 793, No. 5. Donndorff, Beytr. Zool. ii. pt. i. p. 819. Scopoli, Bemerck. Naturg. i. p. 81, No. 94. Müller, Zool. dan. Prodr. p. 16, No. 136. Pallas, Zoogr. R.-A. ii. 1811, p. 360. Temminck, Man. Orn. ii. 1820, p. 936. Bonaparte, Synopsis, 1825, p. 431. Audubon, Orn. Biogr. iii. 1835, p. 112; v. p. 428, pl. 214. Gould, B. Eur. v. 1837, p. pl. 401. Brandt, Bull. Acad. St.-Petersb. ii. 1837, p. 345. Peabody, Rep. Nat. Hist. Massach. 1840, ii., Birds, p. 401. Fleming, Hist. Brit. Anim. 1842, p. 130. Gray, Genera Birds, iii. 1849, p. 637. Thompson, Nat. Hist. Ireland, iii. 1851, p. 235. Bonaparte, Consp. Gav. Comptes Rend. 1856. Bryant, Proc. Bost. Soc. N. H. May, 1861, p. 73. Schlegel, Urinatores Mus. Pays-Bas, 1867, p. 13. Samuels, Ornith. and Oöl. of New England, 1867, p. 564.

Alca (Utamania) torda, Cassin, Baird's B. N. A. 1858, p. 901.

Pinguinus torda, Bonnaterre, Ency. Method. Orn. 1790, p. 29.

Utamania torda, Leach, Stephens, Shaw's Gen. Zool. xiii. 1825, p. 27; quotes "*Alca Hoiieri*, Ray, Syn. 119." Macgillivray, Hist. Brit. Birds, ii. 1852, p. 346. Coues, Pr. A. N. S. Philada. Aug. 1861, p. 249. Boardman, Pr. Bost. S. N. H. Sept. 1862, p. 131. Verrill, *ibid.* Oct. 1862, p. 142. Verrill, Proc. Essex Inst. iii. 1863, p. 160.

Alca pica, Linnaeus, S. N. ed. xii. i. 1766, p. 210; immature or winter plumage. Pallas, Spic. Zool. v. 1769, p. 12. Fabricius, Fn. Groen, 1780, No. 51. Gmelin, S. N. i. pt. ii. 1788, p. 551. Latham, Ind. Orn. ii. 1790, p. 793, No. 5; var. β and γ . Donndorff, Beytr. Zool. ii. pt. i. 1794, p. 818; quotes "*Mergus Bellonii*, Johnston, Av. p. 225." Müller, Zool. Prodr. p. 17, No. 138. Hermann, Tab. Affin. Anim. p. 225. Pallas, Zoogr. R.-A. 1811, ii. p. 361.

Pinguinus pica, Bonnaterre, Ency. Method. Orn. 1790, p. 30.

Utamania pica, Leach, Stephens, Shaw's Gen. Zool. xiii. 1825, p. 30.

Alca balthica, Brünnich, Orn. Bor. 1764, p. 25, No. 101; immature, wanting white line from eye to bill. Gmelin, S. N. i. pt. ii. 1788, p. 551. Müller, Prodr. Zool. p. 17, No. 137. Donndorff, Beytr. Zool. ii. pt. i. 1794, p. 819.

Alca uniaulcata, Brünnich, Orn. Bor. 1764, p. 25, No. 102; young, not having obtained full size and markings of bill.

[Jan.

Alca minor, Brisson, Ornithologia, vi. 1760, p. 92, No. 3, pl. 8, fig. 2.

Alca glacialis et microrhyncha, Brehm.

Habitat.—European and American coasts of the Atlantic, from the higher latitudes, in summer, to the 40°, or thereabouts, in winter. Very abundant. Specimens in all the American museums, and most private collections. Breeds in great numbers on the islands in the Gulf of St. Lawrence, and on the coasts of Labrador and Newfoundland; in winter strays south to New Jersey. Arctic seas of both hemispheres. Rare, or accidental in the North Pacific. Japan! (Schlegel, Mus. Pays-Bas.)

Adult, in summer.—Iris bluish. Mouth chrome yellow. Bill, feet and claws black; the former with a conspicuous curved vertical white line occupying the middle sulcus of both mandibles, continuous from one to the other. A straight, narrow, very conspicuous white line from eye to base of culmen, composed of a series of very short stiff setaceous feathers, sunk below the level of the others. Secondaries narrowly but distinctly tipped with white. Head and neck all around, and entire upper parts black; this on the sides of the head, chin and throat lustreless, velvety, tinged with fuliginous or brownish; on the upper parts glossy and more intense in color. Inner webs of primaries light brownish-gray at base. Entire under parts from the throat, including under surfaces of wings white.

Adult in winter.—Upper parts lighter, duller, more brownish-black; the white of the under parts extending to the bill, and on the sides of the head and neck, sometimes quite to the nape.

Young, first winter.—Similar to the preceding; smaller, the bill weaker, shorter, less elevated, less decurved at the tip, the culmen, rictus and gonyx straighter, the sides of both mandibles smooth, except in the presence of one sulcus; bill brownish-black, the sulcus white. Legs and feet reddish or brownish-black.

Fledgelings.—Bill very small and slender; body clothed with smoky brown or black down, lighter, or tending more or less to grayish-white below.

The white stripe from the eyes to the bill is very variable, though present in the great majority of individuals. It always exists in the adults in summer plumage, but is sometimes absent in specimens, apparently perfectly adult, in winter plumage. Its presence does not seem to be amenable to any very general or constant law: since it may be very evident in very young birds, not yet fully fledged, and again absent in apparently mature specimens, as just stated. In winter specimens it is frequently interrupted and irregular, wanting the sharpness of definition which it has in all cases of adult specimens in summer vesture.

Dimensions: Adult.—Length (average) 18·00, extent about 27·00, wing 7·75, tail 3·50, difference between outer and inner feathers 1·25; tarsus 1·25; middle toe and claw 2·00, outer do. the same, inner do. 1·40; chord of culmen 1·30, its curve 1·50; rictus 2·25; gonyx ·75; nostrils to tip ·85; greatest depth of bill, (just anterior to nostrils,) ·90; greatest width of the corneous portion ·30.

Young.—Length 15·00; extent 22·00; wing 7·00; tail 3·00; tarsus 1·00; chord of culmen 1·00; rictus 1·75, gonyx ·60; greatest depth of bill ·60; greatest width ·20.

No one of the many synonyms of this species involves any doubtful point, all being based upon the winter plumage, or upon the absence of the white line, or upon an undeveloped condition of the bill. "*Alca pica*" was the most firmly established of these, having held its ground until 1825 or thereabouts.

2. Subfamily PHALERIDINÆ.

FRATERCULA, Brisson.

Alca, Linnæus, Syst. Nat. 1744; and in part of subsequent editions; and of the older authors.

1868.]

Spheniscus, Moehring, Av. Gen. 1752. Not of authors.

Fratercula, Brisson, Ornith, 1760; and of many authors.

Lunda, Pallas, Zoog. R.-A. 1811; in part.

Mormon, Illiger, Prodrum, 1811; and of most authors. Type *Alca arctica* L.

Larva, Vieillot, Analyse, 1816. (Type *Alca arctica* L. fide Gray).

Ceratoblepharum, Brandt, Bull. Acad. Imper. St. Petersb. ii. 1837, p. 348. Type *Alca arctica* L.

Bill rather longer than the head, or than the middle toe and claw, nearly as high at the base as long, exceedingly compressed, the sides nearly vertical, the base of the upper mandible with an elevated horny ridge, entirely surrounding it; the basal moiety of the upper mandible with its sides perfectly smooth, forming an elongated oblique triangle with two curved sides; terminal moiety with three or four deep very oblique curved grooves, from commissure to culmen, their convexity looking forwards. Under mandible without a basal ridge, the basal moiety smooth, the terminal with grooves, in continuation of those of the upper mandible. Culmen commencing on a level with the forehead, thence regularly declinate, very convex, with unbroken curve, its ridge sharp, the tip acutely pointed, overhanging. Rictus perfectly straight, except at the end; the angle of the mouth occupied by a circular callosity of membranous tissue; gonys ascending, slightly sinuate, the keel sharp, terminating posteriorly in a thin, elongated, almost hamular process. Nostrils placed just over the commissure, linear, long, reaching nearly across the base of the smooth triangular space of the upper mandible. No nasal fossæ; both eyelids furnished with prominent callosities, in one species developing into a slender acute process. No crest; a peculiar furrow in the plumage behind the eyes, as in *Lomvia*. Wings of ordinary length and shape. Tail contained two and three-fifths times in the wing; the lateral feathers slightly graduated, the central pair shorter than the next ones. Tarsus very short, only equal to the inner toe without its claw; stout, scarcely compressed, covered with minute reticulations, except for a short space in front, which is scutellate. Outer toe about equal to the middle; its claw shorter than that of the middle; middle claw much dilated on the inner edge; middle and outer claws slightly curved, not very acute, upright; inner claw very large, greatly curved, forming a semicircle, exceedingly acute, usually lying *horizontal*, not upright.*

A very peculiar, though well known genus of *Aleida*, without an intimate ally except *Lunda*. The essential characters lie in the structure and configuration of the bill, the rictal and palpebral appendages, and the shape and position of the inner claw; although there are other features involved. *Lunda* is crested, with no furrow in the plumage, no palpebral appendages, and a very differently shaped bill.

Three distinct species represent the genus, as far as known. They are all peculiarly boreal birds, not coming far south even in winter. One is extremely abundant on the shores of the North Atlantic; another inhabits the North Pacific exclusively; another is more particularly a denizen of the Arctic Ocean at large. They may readily be distinguished as follows:

Species, (3).

- I. A slender acute upright horn on the upper eyelid. Black of throat extending to bill..... 1. *corniculata*.

* The peculiar position, no less than unusual shape of the inner claw of this genus is a strongly-marked character, not found in any other except *Lunda*. The great curvature and extreme sharpness of the claw could not be maintained were it vertically placed like the other claws, as it would be worn down by constant impaction against the rocks which the birds habitually alight upon. But in the usual attitudes and movements of the birds it lies perfectly flat on its side, and is so preserved intact. The birds make great use of this claw in digging their burrows or in fighting; and the preservation of the instrument for these purposes is evidently the ulterior design of the peculiar direction of its axis. The birds have the power of bringing it, on occasion for use, into a vertical position. These facts, mayhap, are not generally known. See Pr. A. N. S., Phila., 1861, p. 264.

II. A short blunt process on the upper eyelid. A black ring around the neck, not extending to bill.

Bill moderate; chord of culmen 2.00, the curve 2.10, the ordinate .30; depth at base 1.40 (average), wing 6.50..... 2. *arctica*.

Bill large; chord of culmen 2.40, the curve 2.60, the ordinate .45; depth at base 1.70 (average), wing 7.25... 3. *glacialis*.

FRATERCULA ARCTICA (L.) Steph.

Alca arctica, Linnæus, S. N. x. ed. 1758, i. p. 130, n. 3. Linnæus, S. N. xii. ed. 1766, i. p. 211, n. 3. Quotes *Anas arctica*, Clus., *Lunda*, Gesner, *Pica marina*, Ray, *Psittacus marinus*, Anders. Brünnich, Orn. Bor. 1764, p. 25, No. 103. Gmelin, S. N. i. pt. ii. 1788, p. 549, No. 4. Latham, Ind. Orn. ii. 1790, p. 792, No. 3. Blumenbach, Handb. Naturg. p. 228, No. 1. Müller, Prodr. Zool. p. 17, No. 140. Hermann, Tab. Affin. Anim. p. 150. Donndorff, Beytr. Zool. ii. pt. i. 1794, p. 815.

Lunda arctica, Pallas, Zoog. R.-A. 1811, ii. p. 365, pl. 83. Schlegel, Urinatores Mus. Pay-Bas. livr. ix. 1867, p. 28. (In part. Confounds *glacialis* Leach with the present species.)

Fratercula arctica, Stephens, Shaw's Gen. Zool. xiii. 1825, p. 37. Quotes "*labradora* Gm. Lath." as syn. Fleming, Hist. Brit. Anim. 1842, p. 130. Thompson, Nat. Hist. Ireland, iii. 1851, p. 221. Gray, Gen. Birds, iii. 1849, p. 637.

Fratercula (Ceratoblepharum) arctica, Brandt, Bull. Acad. St. Petersb. ii. 1837, p. 348.

Mormon arctica, Illiger, Prodromus, 1811, p. Naumann, Isis. v. Oken, 1821, p. 783, pl. 7, figs. 5, 6, 7. Audubon, Orn. Biog. iii. p. 105, pl. 213. Oct. Ed. vii. pl. 464. Nuttall, Man. Orn. ii. 1834, p. 548. Bonaparte, Synopsis, 1828, p. 430. Peabody, Rep. Nat. Hist. Mass. 1840, ii. Birds, p. 401. Macgillivray, Hist. Brit. Birds, 1852, ii. p. 365. Coues, Fr. A. N. S. Phila. Aug. 1861, p. 251. Boardman, Pr. Bost. Soc. N. H. Sept. 1862, p. 131. Verrill, Proc. Bost. Soc. N. H. Oct. 1862, p. 142. Verrill, Proc. Essex Inst. iii. 1864, p. 160. Samuels, Ornith. and Ool. of New England, 1867, p. 566.

Mormon (Fratercula) arctica, Bonaparte, Comptes Rendus, Apr. 1856, p. 774. Cassin, Birds N. A. 1858, p. 903.

Mormon fratercula, Temminck, Man. Orn. ii. p. 933. Gould, Birds Europe, v. 1837, p. pl. 403.

Mormon polaris et Grabs, Brehm.

Alca deleta Brünnich, Orn. Bor. 1764, p. 25, No. 104. Young.

Alca labradorica, Gmelin, S. N. i. pt. ii. 1788, p. 550, No. 6. Based upon the "*Labrador Auk*" of Pennant, A. Z. 1785, ii. p. 512, No. 428; * and Lath. Syn. iii. i. p. 318, No. 4. "Hab. in terra Labrador; *Arcticæ* magnit. 12 ferè poll. long. Rostr. angustum, mand. sup. obscure rubra, inf. albida nigro maculata; tempora obscure alba, gula, alæ, et cauda brevis obscure, pedes rubri." Bonnatere, Ency. Method. Orn. 1790, p. 33. Donndorff, Beytr. Zool. ii. pt. i. 1794, p. 817.

Alca labradora, Latham, Ind. Orn. ii. 1790, p. 793, No. 4. Same basis as that of Gmelin. "Rostro carinato, mand. inf. gibba, ad apicem macula nigra, oculorum orbita temporibusque albidis, * * color corporis ferè ut in *arctica*," etc.—Not *Sagmatorrhina labradora* Cassin, which is *S. Lathamii* Bp.

Spheniscus, Moehring, Av. Gen. 1752, p. 62, No. 64. Based on "*Colymbi species et Alcæ species*" of Linnæus' sixth edition. "Rostrum subonatum, lateri-

*The following is Pennant's description:—"With the bill an inch and a quarter long, much carinated at top, not very deep, a little convex; upper mandible dusky, lower whitish, marked with a black spot, and angulated like that of a gull; crown and upper part of the body, wings and tail, dusky; lower part white; legs red. Size of the former," (*Arctica*.) "Inhabits the Labrador coast?—Br. Mus."

bus angustissime et perpendiculariter compressis, cutis callosa dura in basi mandibuli superioris. Ad supercilia cornu breue," etc.

Coasts and Islands of the North Atlantic, very abundant. Rare in the North Pacific, (Pallas,) where replaced by *F. corniculata*. In winter, south on the American Coast to Massachusetts. Breeds on the islands in the Bay of Fundy, (Boardman). Numerous specimens in all American Museums.

Adult (breeding plumage).—Iris hazel brown. Eyelids vermilion red, the fleshy callosities bluish ash. Base of bill and first ridge dull yellowish, the smooth contained space bluish, rest of bill vermilion red, the tip of the lower mandible and the two terminal grooves yellowish. Legs and feet coral red, claws black. Crown of head grayish black, the edges of which are sharply defined against the color of the sides of the head, chin and throat, and the posterior edge of which is separated by a very narrow but distinct transnuchal stripe of ashy from the color of the back. Sides of head, with chin and throat ashy white; nearly white between the eyes and bill, and with a maxillary stripe or area of blackish ash on either side of the throat. A narrow, distinct line of white along the anterior edge of the antibrachium. Entire upper parts glossy black, with a bluish lustre, continuous with a broad collar of the same around the sides and front of the neck. Under parts from the neck pure white, the elongated feathers of the flanks and sides blackish. Under surface of wings pearly ash-gray; inner webs of primaries and secondaries dull gray-brown, the shafts brown, blackish at tip and whitish towards the base.

Length 13.50, extent 24.00, wing 6.50, tail about 2.25; tarsus 1.00; middle toe 1.40, its claw .40; outer toe 1.40, its claw .30; inner toe 1.00, its claw .40; bill—chord of culmen 2.00, its curve 2.10; depth of bill at base 1.40; rictus 1.25; gonyx 1.45; greatest width of bill (which is at base of nostrils) .60; length of nasal slit .35.

Young.—Bill much smaller and weaker than in the adult; without the basal ridge, and with only slight indications of the warty callosities at angle of rictus; the terminal grooves wanting, or faintly indicated; the culmen much less convex; the gonyx convex and ascending posteriorly, without the sharp hamular process at base. Such are the general characteristics of the young, though full-grown bird. Birds not grown have their bill much smaller still, entirely without grooves or ridges, acute at the apex, the culmen and gonyx perfectly straight; the lateral aspect of the bill is almost an equilateral triangle. Bill basally blackish; terminally yellowish. Legs and feet reddish yellow, obscured with dusky. The eyelids want the fleshy processes. In colors of plumage the young birds are almost exactly like the parents, except that the ashy of the sides of the head is tinted with sooty black, more or less directly continuous with the black of the crown, and lightening into a dusky ash on the auriculars and lower parts of the sides of the head.

Nestlings are covered with blackish down, becoming whitish on the under parts from the breast backwards.

This species presents little variation in any respect from the conditions as above described. The dimensions do not vary much, and even the bill is very constant in size, shape and colors. The plumage of the adults scarcely presents appreciable variation.

The protuberance on the lower eyelid is horizontal, and occupies the whole length of the lid. That on the upper eyelid is nearly perpendicular, and higher than broad; but is short, obtuse and never developed into an acute process.

There is absolutely no difference between American and European specimens. The foot note on page 251, Pr. A. N. S. Phila. for 1861, is to be cancelled as wholly erroneous.

No bird of the family of *Alcidæ* is better known than the present species. It is the type of the Linnæan genus *Alca* of 1744, but not of 1758, nor of subse-

[Jan.

quent editions of the "System." Though so long known, it has few synonyms beyond those resulting from its reference to divers genera. Alca "deleta" Brännich, is the young bird. So also, beyond a doubt, is the Alca "labradorica" of Gmelin, which has been so differently interpreted by various authors. Bonaparte even says it is *certainly* his *Sagmatorrhina Latham*, though he does not adopt the name *labradorica*, as it would imply a geographical error. Mr. Cassin, however, uses it in connection with the *Sagmatorrhina*. It is based upon the "Labrador Auk" of Pennant. The diagnosis of this author, and that given by Gmelin and Latham, are reprinted above, for facility of reference. If the reader will take the trouble to study these three descriptions, he will not be likely to regard them as diagnoses of *Sagmatorrhina Latham*.

This species is the type of Moehring's genus *Spheniscus*; and a person addicted to iconoclasm in the matter of nomenclature might cut a fine dash on the strength of this fact.

FRATERCULA GLACIALIS, Leach.

Mormon glacialis, "Leach," Naumann, Isia, 1821, p. 782, pl. 7, fig. 2. Not of Audubon and Gould, who figure and describe *corniculata*. Newton, Ibis, 1865, p. 212. Malmgren, Cab. Journ. f. Ornith. xiii, 1865, p. 394; critical discussion of relationships to *arctica*.

? *Mormon glacialis*, Bonaparte, Synopsis B. U. S. 1828, p. 429. Probably only *arcticus*. Boardman, Pr. Bost. Soc. Nat. Hist. Sept. 1862, p. 132; and Ver-rill, Proc. Essex Inst. iii, 1864, p. 160. Grand Menan, Bay of Fundy. These two authors rely for the locality upon Audubon's authority, very questionable in this instance.

Fratercula glacialis, Leach, Stephen's Cont. Shaw's Gen. Zool. xiii, 1825, p. 40, pl. 4, fig. 2. Gray, Genera Birds, iii, 1849, p. 637.

Mormon (Fratercula) glacialis, Bonaparte, Tab. Comparatif Pelagiens, Comptes Rendus, xlii, 1856, p. 774. Cassin, Baird's B. N. A. 1858, p. 903.

Lunda arctica, Schlegel, Urinatores Mus. Pays-Bas, ix. livr. 1867, p. 28, in part; "Specimina aliquantulum majora ex insula Spitzbergen."

Coasts of the North Atlantic; but a more boreal species than *F. arcticus*; Arctic Ocean. Spitzbergen. Near Port Foulke, Greenland, (Mus. Smiths. Inst.), "Europe," Greenland, (Mus. Acad. Philada.) Not authenticated as occurring on the coast of Maine.

(No. 24,362, Mus. Smiths., near Port Foulke, Greenland, Aug., 1861; adult; Dr. I. I. Hayes.) With the colors, and much the general aspect of *F. arcticus*. Larger than that species. Protuberance on upper eyelid more decidedly acicular; in fact intermediate in size and pointedness between that of *F. arctica* and *F. corniculata*. Bill much larger, comparatively and absolutely, than that of *arctica*, and differently shaped; its colors about the same. Bill very deep at the base, the basal ridge rising high on the forehead; culmen much arched, towards the end dropping nearly perpendicularly downwards, so great is its convexity. Upper mandible with four decided grooves; the lower with three, being one more on each than is usual in *arctica*. Gonyes more convex in outline, yet not produced posteriorly into so acute a hamular process. Length 14.50; extent about 26.00; wing 7.25; tail 2.25; tarsus 1.20; middle toe and claw 1.90, outer do. 1.90, inner do. 1.45; bill: chord of culmen 2.40, its convexity 2.60, ordinate of the curve .45; depth of bill at base 1.70, length along rectus 1.50, along gonyes 1.60; greatest width of bill .65; length of nasal aperture .40.

The development of the bill, changes of plumage, and individual variations of this species are doubtless identical with those of *arctica*. Young birds of the two species might not be satisfactorily distinguishable.

Though this species is so very near *arctica* it is probable that the majority of authors would accord to it specific rank. It is apparently larger in all its parts; the callosity on the upper eye-lid tends in shape towards that of *corniculata*; the bill is not only much larger every way than that of *arctica*, but has

a decidedly different shape, owing chiefly to its greater depth at base, as compared with its length, and much greater convexity of culmen. The only questionable relationship is with *arctica*; the bird is certainly not *corniculata*.

This species is usually cited by New England writers as occurring off the coast of Maine in winter. (Grand Menan, entrance of the Bay of Fundy.) In this, however, they only quote Audubon's authority, which is not reliable in this instance, as he himself says that he "rather supposed than was actually certain that the birds observed were large-billed Puffins." The case is rendered still more problematical by the fact that Audubon's "Large-billed Puffin, *Mormon glacialis* Leach," is really the *corniculata* Naumann, described and figured from specimens procured in London, from Mr. Gould, who also, in the "Birds of Europe," mistakes the true *glacialis* Leach for *corniculata* Naumann. Subsequent writers will do well to expunge the name of this species from their local lists of the birds of New England. It is exceedingly improbable that the true *corniculata* occurs on the New England coast.

This species is usually cited as having been introduced in Stephens' Continuation of Shaw's General Zoology (1825); but must have appeared some years previous, since Naumann quotes "*Mormon glacialis* Leach," in the Isis, 1821. It was probably named by Leach about 1816-18.

FRATERCULA CORNICULATA, (Naumann), Gray.

Mormon corniculata, Naumann, Isis v. Oken, 1821, p. 782, pl. 7, figs. 3, 4. (Kamtschatka.) Cassin, Pr. A. N. S. Philada. 1862, p. 324. (Behring's Straits.)

Mormon (Fratercula) corniculata, Bonaparte, Comptes Rendus, 1856, p. 774. Cassin, Baird's B. N. A. 1858, p. 902.

Fratercula corniculata, Gray, Gen. Birds, iii, 1849, p. 637, pl. 174.

Fratercula (Ceratoblepharum) corniculata, Brandt, Bull. Acad. St. Petersb. ii, 1837, p. 348. Quotes "*Mormon corniculatum*, Kittlitz, Kupfer, i."

Mormon glacialis, Audubon, Orn. Biogr. iii, 1835, p. 599, pl. 293, fig. 1. Id. B. Amer. vii, p. —, pl. 463. Not of authors. Gould, Birds Eur. v, 1837, pl. 404. Not of authors.

? *Fratercula glacialis*, Vigors, Zool. Voy. Blossom, 1839, Ornith. p. 33. Probably not true *glacialis*.

Lunda corniculata, Schlegel, Urinatores Mus. Pays-Bas, livr. ix, 1867, p. 28.

Coasts and Islands of the North Pacific and Arctic oceans. Kamtschatka, (Mus. Acad. Phila.) Sitka, (Schlegel, Mus. Pays-Bas.) Kotzebue Sound, and St. Michael's, Russian America, (Mus. Smiths. Inst.) Southern extension on west coast of America not determined. Not recorded from the North Atlantic.

Adult, breeding plumage. (No. 46,503, Mus. Smiths., St. Michael's, Russian America, June 27, 1866; H. M. Bannister.) Bill very large, especially high at the base for its length, the height being about equal to the chord of the culmen, exclusive of the width of the basal rim; base of culmen and angle of gonys both produced far backward, giving a greatly curved outline to the base of the bill along the feathers of the sides of the head; sides of the bill not distinctly divided into two compartments; nearly plane and smooth in their entire length, with only three faintly pronounced short grooves; culmen exceedingly convex, regularly arched in the arc of a perfect circle; the tip of the upper mandible acute, moderately overhanging, the basal rim broad and prominent; rictus (not including the part beyond the basal rim of the upper mandible) very short, only equal to the height of the upper mandible at base; gonys sinuate, at first convex in outline, then slightly concave; its length but little less than the chord of the culmen.*

Appendage of the upper eye-lid produced into a long, slender, acutely pointed

* The lower mandible in this specimen is so thin near the angle of the gonys as to be transparent. Ordinary type can be read through it.

upright spine; that of the lower eye-lid much as in other species of the genus.

Form otherwise as in *F. arctica* and *glacialis*. Larger than the former, about the size of the latter.

Crown of the head deep grayish black; the patch of this color triangular in shape, narrowing anteriorly to a point at the base of the culmen. Sides of the head white; the furrow in the plumage behind the eye, and the sides of the lower jaw tinged with dark ash. A narrow distinct line of white along the edge of the fore-arm. Entire upper parts very glossy blue-black; a duller, more fuliginous shade of black encircling the neck before, and running forwards on the throat and chin quite to the bill. Other under parts pure white, except a few elongated blackish feathers on the sides and flanks. Under surface of wings dark pearly ash. Legs and feet orange red, the webs tinged with vermillion. Claws brownish black. Palpebral appendages apparently ashy black. Bill yellow, tinged with red, the terminal portion blackish. Rictal callosities brilliant yellow orange.

Length 14.50; extent 24.50; wing 7.25; tail 2.75; tarsus 1.10; middle toe and claw 2.00; outer do. 1.90; under do. 1.35; bill: chord of culmen 2.00, its curve 2.25; rictus from basal rim to tip 1.20; gonys 1.75; depth of bill at base 1.80; its greatest width .60; length of nasal slit .40; length of superior palpebral appendage .35.

This interesting species may be recognized at a glance by the prominent horn over the eye, and the extension of the black collar on the throat to the bill. The bill also differs from that of either of the other species in its shortness, compared with its great depth at the base, and the nearly smooth sides, which are not distinctly divided by a ridge or groove into two compartments. The bill is also comparatively thinner than that of the other species, and differently colored.

Prof. Naumann first described this species from Kamtschatka in his valuable memoir on the genus in the *Isis*, as above cited. It has been occasionally confounded with *glacialis* Leach, which is quite a different bird. It is a North Pacific and Arctic species, not recorded from the Atlantic. Excellent specimens are contained in the Philadelphia Academy and Smithsonian Institution; one of those in the collection of the last named is probably the original of Audubon's plate of "*glacialis*."

LUNDA, Pallas.

Alca, Pallas, Spic. Zool. v, 1769; in part; and of some elder authors.

Lunda, Pallas, (ex Gesn.) Zoog. R.-A. 1811. Type *Alca cirrhata*, Pallas.

Mormon, Illiger, Prodrôme, 1811; in part; and of most authors.

Fratercula, Stephens, Shaw's Gen. Zool. xiii, 1825; in part; not of Brisson.

Gymnoblepharum, Brandt, Bull. Acad. Imper. St. Petersburg, ii, 1837, p. 349.

Type *Alca cirrhata*, Pallas.

With somewhat the general aspect of *Fratercula*. No horny appendages to the eyelids. No furrow in the plumage behind the eyes. An extremely elongated crest on each side of the head. Upper mandible with only an indication of a basal ridge along its sides; the culmen divided into two parts, whereof the basal is surmounted by a prominent widened ridge, ending abruptly; sides of upper mandible with three well marked curved grooves, widely separated, whose convexity points backwards. Under mandible with its sides perfectly smooth, and its base very convex, not concave. Rictus very sinuate; gonys slightly curved. Feet, wings and tail as in *Fratercula*.

The above diagnosis indicates only the principal features wherein this genus—or subgenus, as might be contended with some reason—differs from *Fratercula*. Except in the bill, eye-lids and crest, the genus is exactly *Fratercula*, but the differences in these points seem sufficient to warrant generic separation.

1868.]

LUNDA CIRRHATA, Pallas.

Alca cirrhata, Pallas, Spic. Zool. 1769, v, p. 7, pl. 1, and pl. 2, figs. 1, 2, 3. Quotes Steller, Nov. Comm. Petrop. iv, p. 421, pl. 12, fig. 16. Gmelin, S. N. i, pt. ii, 1788, p. 553. Quotes Pennant, A. Z. ii, p. 513, No. 432. Latham, Ind. Orn. ii, 1799, p. 791, No. 2. Donndorff, Beytr. Zool. ii, pt. i, p. 822, No. 10. Quotes *Anas arctica cirrhata*, Steller. Sander, Grösse u. Schönh. in Natur. i, p. 244. Hermann, Tab. Aff. Anim. p. 150; and of the other early authors.

Lunda cirrhata, Pallas, Zoog. R.-A. ii, 1811, p. 363, pl. 82. Schlegel, Urinatores Mus. Pays-Bas, 1867, p. 27.

Mormon (Lunda) cirrhata, Bonaparte, Comptes Rend., 1856, p. 774. Cassin, Baird's B. N. A. 1858, p. 902.

Mormon cirrhata, Bonaparte, Syn. 1828, p. 429. Audubon, Orn. Biogr. iii, 1835, p. 36; pl. 249, figs. 1, 2. (Kennebec R., Me.) Audubon, B. Amer. vii, 1844, p. —, pl. —. Boardman, Proc. Bost. Soc. N. H. 1862, p. 132. (Maine). Verrill, Proc. Essex Inst. iii, 1864, p. 160. (Maine). Heermann, Pac. R. R. Rep. x, 1859, Route to California, Birds, p. 76. Cooper and Suckley, Pac. R. R. Rep. xii, pt. ii, 1859, p. 283.

Mormon cirrata, Naumann, Isis, 1821, p. 781, pl. 7, fig. 1.

Fratercula cirrhata, Stephens, Shaw's Gen. Zool. xiii, 1825, p. 40. Vieillot, Gal. Ois. ii, 1825, p. 240, pl. 296. Vigors, Zool. Voy. Blossom, Ornith. 1839, p. 33. Gray, Gen. Birds, iii, 1849, p. 637. Cassin, Pr. A. N. S. Phila. 1862, p. 324.

Fratercula (Gymnoblepharum) cirrata, Brandt, Bull. Acad. St. Petersb. ii, 1837, p. 349.

Arctic Ocean; Coasts and Islands of the North Pacific; on the American side south to California; of occasional occurrence on the Atlantic Coast of North America, (Kennebec River, Audubon: spec. obtained; Bay of Fundy, in winter, Verrill,) Spec. in Mus. Acad. Philada., Mus. Smiths., Cab. Geo. N. Lawrence, author's Cab., etc.

Bill very large and heavy, much longer than the head or middle toe and claw, its depth at base three-fourths its length; excessively compressed, the sides nearly perpendicular, except at base of upper mandible, where they bulge a little. Upper mandible divided into two portions; the basal part with its sides perfectly smooth, bounded along the base by a slight oblique ridge of subcorneous tissue, which is scarcely, however, elevated above the common plane, and is minutely studded with points; bounded above by a prominent wide ridge formed of an accessory corneous piece which surmounts this portion of the culmen; bounded below by the nasal slit; bounded anteriorly by a deep groove whose convexity looks backwards; these four boundaries enclosing a subtrapezoidal space. The terminal part smooth, except in the presence of three widely separated, oblique, curved, deep grooves, whose convexity looks backwards. Lower mandible with the sides perfectly smooth, the base convex, the convexity looking backwards, with slight indication of a ridge of punctulated subcorneous tissue. General outline of culmen convex; this convexity, however, interrupted near the middle by a notch, forming a re-entrant angle between the two parts of the culmen, each of which, taken separately, is convex in outline—the anterior part the most so. Rictus exceedingly sinuate, the tip of the upper mandible being almost perpendicularly hung over that of the lower; the angle of the mouth occupied by a large fibrous or membranous excrescence, nearly circular in outline, turgid in life; in the dry state shrunken and minutely punctulated. This peculiar warty excrescence seems of nearly the same structure as the base of the bill itself, with which it is directly continuous. Nasal slit short, linear, subbasal, placed close to the commissural edge of the upper mandible. Palate and floor of mouth both deeply excavated; the cutting edge of both mandibles exceedingly sharp.

The eyelids are naked along the edge, but present no thickening or unusual

[Jan.

fleshiness. The crest springs chiefly from what would otherwise be a naked linear groove in the plumage from the eyes to the extreme occiput. Some of the feathers begin to grow much above, if not a little anterior to, the eyes. The crest in perfectly adult birds is more than *four* inches long. The feathers have exceedingly slender, delicate shafts, and loose, entirely disconnected, though quite lengthy fibrillæ; and a peculiar silky glossiness.

The wings are of the usual size and shape in this family. The tail is comparatively somewhat longer, perhaps, than in any other Alcidine bird; the lateral feathers a little graduated; the central pair shorter than the next, producing an emargination. The legs are as in *Fratercula*. The claw of the inner toe presents the curious character which has already been dwelt upon in connection with *F. arctica*.

Adult.—Bill orange-red; the basal moiety of both mandibles livid horn or enamel color; the punctulated basal ridge, and rictal callosities more yellowish. Legs and feet obscure reddish; the webs bright coral red; claws brownish-black. Edges of eyelids red; "iris pale blue." Crests pale straw-yellow; some of the posterior feathers, which grow from the black part of the head, black at base. Face pure white, abruptly defined. This white occupies the lores and sides of the head to the base of the crest, and encircles the bill, broadly on the sides, narrowly above and below. The black of the crown comes down the forehead to within a fourth of an inch of the culmen; just filling the crown between the crests, and ending with a directly transverse outline. The white on the side of the lower jaw extends to within about the same distance from the under mandible. A narrow, very distinct pure white line along the anterior edge of the fore-arm. Entire upper parts, and under tail coverts glossy black; sides of head and neck, and throat and breast fuliginous brownish-black; other under parts the same, but more grayish; under surfaces of wings smoky gray. Wings and tail black; the inner webs of the feathers brownish-black; the shaft of the first primary whitish on its under surface towards its base.

The preceding description is taken from an unusually fine specimen (No. 46,494, Mus. Smiths. ♂, Sitka, May, 1867), representing the very highest condition of maturity. The crest is more than four inches long. It is not often that such very perfect specimens are met with in collections.

Length between 15.00 and 16.00; wing 7.75; tail about 2.00; tarsus 1.30; middle toe 2.00, its claw .50; outer toe 1.80, its claw .40; inner toe 1.25, its claw .50; bill: greatest depth (a little in front of extreme base) 1.90; greatest width (at angle of mouth) .90; chord of culmen 2.40, of which the terminal portion is 1.40; rictus about 1.90; gonys 1.60; greatest depth of upper mandible 1.15; nostrils .25 long.

Young (full grown).—Bill smaller than in the adult, and not so deep at the base; sides of terminal moiety of upper mandible perfectly smooth; chord of culmen 2.00; depth of bill at base 1.40. No crest; slight indications of it in some short yellowish filamentous feathers on the auriculars. White line on fore-arm imperfect. White about head as in the adult; but the black reaches nearly or quite to the base of the culmen and gonys. Otherwise like the adult; the under parts rather more grayish. The bill and feet appear to have been less brightly colored.

This strange bird fairly disputes with *Phaleris pinnacula* the claim to be regarded as the oddest of the odd species of this family. The peculiar configuration of the bill strongly characterizes it at all ages, independently of its remarkable head-markings. Though known for about a century, it has received no specific synonyms from any of the writers whose works have been examined in the preparation of the present memoir. Specimens are contained in nearly all the American collections. The bird is authenticated as occurring on the coast of Maine.

1868.]

CERATORHYNCHA, Bonaparte.

Alca, Pallas, Zoog. R.-A. ii, 1811, in part; not of authors.

Phaleris, Bonaparte, Zool. Journ. iii, 1827; not of authors.

Cerorhina,* Bonaparte, Syn. U. S. Birds, 1828. Type *C. occidentalis*, Bp. = *A. monocerata*, Pall.

Chimerina, Eschscholtz, Zool. Atlas, 1829. Type *C. cornuta*, Esch. = *A. monocerata*, Pall.

Uria, Audubon, B. Am. vii, 1844, in part; not of authors.

Simorhynchus, Schlegel, Mus. Pays-Bas, 1867, livr. ix, in part; not of Merrem.

Base of upper mandible with a large upright horny protuberance. Under mandible with an accessory corneous piece interposed between its rami, near their symphysis. Bill shorter than the head, stout, very deep at the base, tapering rapidly to the tip, much compressed, the sides erect, smooth, the culmen very convex, the rictus gently curved, the gonys nearly straight, except at symphysis, where it is bulging. Nostrils short, linear, subbasal, marginal, impervious. Eye small; no palpebral appendages. No crest; no furrow behind the eyes; slender elongated feathers on each side of the head. Inner lateral claw of usual size, shape and position. Other details of form almost exactly as in *Fratercula*. Size large; general form robust.

This curious genus may readily be distinguished from all others of the family by the characters indicated in the two first sentences of the above diagnosis. The intercalation of an accessory corneous element at the mandibular symphysis is an entirely unique feature in this family. It seems very much like the "interramicorn," as the writer has elsewhere called it, which is found in the albatrosses, as one of the characters which distinguish those birds from other *Procellariidae*. In the present instance, it is a feature of especial importance and value, as it helps greatly to distinguish this genus from *Sagmatorrhina*, or, to be more explicit, to separate *S. Suckleyi* from *C. monocerata* in every stage of growth.

The affinities of this genus are decidedly with *Fratercula*, after *Sagmatorrhina*, of course. Aside from the peculiarities of the bill, it agrees with the former in most points of structure, except the eyes and inner lateral claw. It does not require comparison with any other genus. It is represented by only a single species, according to the writer's way of thinking,—*Suckleyi* falling most naturally, as well as can be judged at present, in *Sagmatorrhina*.

CERATORHYNCHA MONOCERATA (Pall.) Cass.

Alca monocerata, Pallas, Zoog. R.-A. ii, 1811, p. 362, No. 414.

Cerorhina monocerata, Cassin, Baird's B. N. A. 1858, p. 905. Cooper and Suckley, Pacific R. R. Rep. xii, pt. ii, 1859, p. 284.

Simorhynchus monocerata, Schlegel, Urinatores Mus. Pays-Bas, livr. ix, 1867, p. 26.

Cites *Sagmathorina* [lege *Sagmatorrhina*] *Latham* Bp. and *Cerorhina Suckleyi* Cass. as young.

Phaleris cerorhynca, Bonaparte, Zool. Journ. iii, 1827, p. 53.

Cerorhina occidentalis, Bonaparte, Syn. Am. Birds, Ann. Lyc. N. Y. iv, 1828, p. 428. Nuttall, Man. ii, p. 538. Vigors, Zool. Voy. Blossom, 1839, Ornith. p. 33.

Ceratorhyncha occidentalis, Bonaparte, Comp. List, 1838, p. 66. Bonaparte, Conspectus. Comptes Rendus, 1856, xlii, p. 744.

Ceratorhina occidentalis, Audubon, Orn. Biog. 1839, v, p. 104, pl. 402, fig. 5.

Cerorhina occidentalis, Gray, Genera Birds, iii, 1849, p. 639. Heermann, Pac. R. R. Rep. x, 1859, Route to California, Birds, p. 75.

Uria occidentalis, Audubon, B. Am. vii, 1844, p. 364, pl. 471.

* This word is spelled in a great variety of ways, both by Bonaparte himself, and other authors. We find *Cerorhina*, *Cerorrhina*, *Ceratorrhina*, *Cerorhinea*, *Cerorhynca*, *Ceratorhyncha*, *Ceratorrhyncha*, etc. The orthography above cited is that apparently first given by Bonaparte, but is obviously erroneous.

Cerorhina orientalis, Brandt, Bull. Acad. St.-Petersb. ii, 1837, p. 348. By a lapsus calami for "occidentalis."

Chimerina cornuta, Eschscholtz, Zool. Atlas, 1829, iii, p. 2, pl. 12.

American and Asiatic coasts and islands of the North Pacific. Japan (Perry's U. S. Expl. Exped.), Kamtschatka (Mus. Acad., Philada.), Pacific coast of N. A. from Russian America to Farallone Islands, Cal. (Mus. Smiths. Inst.) Breeds as far south as Japan and California.

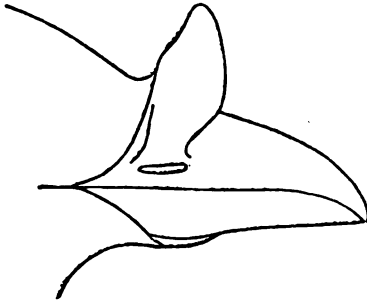


Fig. 1.—*C. monocerata*.
Nat. size. Adult female.

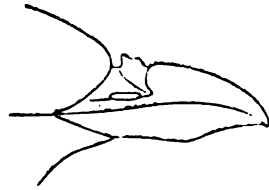


Fig. 2.—*C. monocerata*.
Nat. size. Young scarcely fledged.

Adult, breeding plumage, (No. 46,517, Mus. Smiths. ♀, Sitka, May, 1866).—Bill orange-yellow, culmen and base of upper mandible dusky; horn dull yellowish. Feet apparently dusky yellow; below, with the tarsi posteriorly, blackish; claws black. Crown of head, back of neck, and entire upper parts glossy blue-black. Sides of head and neck, and of body along under the wings to the flanks, with chin, throat and upper part of breast, and under surfaces of wings, clear grayish ash, pretty trenchantly defined along its line of junction with the black. Under parts from the breast pure white; this color shading insensibly into the ashy on the breast and sides. A line of white along the edge of the fore-arm. Exposed portions of wing and tail feathers black; their inner webs greyish-brown, basally lighter, the shafts of the primaries dull whitish at base. A series of elongated, stiffish, acicular feathers on the side of the head from the rictal angle; another similar series from the eye backwards to the sides of the nape, pure white. The individual feathers are about an inch, more or less, in length; the length of the white stripes produced by them collectively is about two inches.

Length 15.50; wing 7.25; tail 2.50; tarsus 1.20; middle toe and claw 1.85, outer do. 1.70, inner do. 1.40; chord of culmen, excluding width of horn, 1.00, including it 1.40; rictus 2.00; gony, including length of accessory piece, 1.10; height of bill from tip of horn to protuberance at symphysis 1.25; from culmen at base of horn to same .80; nostril to top of horn .75.

Immature, but with a perfectly developed horn, and accessory symphyseal piece (No. 23,391, Mus. Smiths., Straits of Fuca).—Colors somewhat as in the preceding; but the white of the under parts everywhere obscured by ashy-gray, which tinges the tips of the feathers, giving a marbled aspect to the parts, lightest on the middle of the belly, shading insensibly on all sides into the uniform ashy-gray of the other under parts. Black of upper parts, especially on the head, with a decided brownish tinge. Only traces of the acicular white feathers on the sides of the head. Bill smaller than before; the horn, however, perfectly developed, rising nearly half an inch above the culmen. Rather 1868.]

smaller than the preceding; length between 14 and 15 inches, wing barely 7, bill along rictus 1.60, its depth at base, exclusive of height of horn, .65.

Young. (No. 23,392, Mus. Smiths., Straits of Fuca).—This specimen is just not quite fully feathered, patches of down adhering here and there. The bill is small and weak, hardly more than half the size of that of the adult; its general shape, however, is nearly attained. The base of the upper mandible is covered with a soft skin, about as far as the end of the nostrils. That part of the culmen formed by the ridge of this skin is sunken below the level of the rest. Unmistakable indications of the future horn are present, in a small knob on the ridge of this skin. In the present dried state this knob is shrunken, presenting the appearance represented in the plate. In life it was probably a small full rounded protuberance, rising a little above the level of the culmen. Between the mandibular rami, at the symphysis, there is a slight fold or ridge of skin, evidently the matrix of the future accessory corneous element. The upper mandible is mostly blackish; the lower dull obscured reddish. The legs and feet appear to have been colored much like those of the adult. The colors of the plumage are precisely those of the specimen last described; the patches of down are smoky brown. There is no trace of white about the head.

Nestling, about $5\frac{1}{2}$ inches long. (Farrallone Islands. Mus. Acad. Phila.) All over smoky brown, lighter and more grayish below.

The horn of this bird, always present in the adult, and always indicated, even in the scarcely feathered young, as we have just seen, varies a great deal in the details of its size and shape. It is usually nearly upright, but frequently projects a little obliquely forward. Its average height is between four and five-tenths of an inch, measuring from the level of the culmen at the anterior edge of the root of the horn. The real roots of the horn begin a little above the nasal aperture; the nostril opening just beneath the lower edge. The horn is thus bifurcated, as it were, at the base, and saddled on the base of the upper mandible. The anterior outline is usually straight, or slightly curved, the apex rounded, and the posterior border irregular in outline. The figure represents what is perhaps an average horn. It would be impossible to indicate all the variation in detail; scarcely two horns are precisely alike.

The frontal feathers ascend a very little way up the back of the horn in the majority of instances; sometimes, however, they end abruptly at its base. From their foremost point they sweep downwards and backwards along the side of the upper mandible with a gentle regular curve, to the rictal angle, leaving the tomial edges of the upper mandible bare. The chin feathers begin at the accessory symphyseal piece, rise quickly on the sides of the under mandible, and reach its tomial edge in advance of the rictal angle.

The symphyseal piece, which is developed from the skin at the apex of the interramal space, is, when fully formed, as hard as the rest of the bill. Anteriorly it is directly continuous with the mandibular symphysis. On its sides, a groove indicates its line of cohesion with the mandibular rami. The horn, when mature, is perfectly corneous and hard to its extreme base; there being no soft skin even about the nostrils. Its main shaft is hollow; a tube is disclosed when the top is worn off or broken off.

The white feathers on the side of the head differ from those of other Phalaridines (except *S. Suckleyi*) in not being very slender, filamentous and wavy. They are straight, short, acutely pointed, stiffish, standing discreet from each other, like so many narrow spear-points.

The very large series of this bird examined warrant the belief that the horn is always present, accidents of course not considered; that it begins to be apparent even before the bird is fully fledged, as a slight knob. That, in like manner, the accessory symphyseal piece is always developed; and that its beginning may be detected at a very early age. These facts must be borne in mind in discussing the unusually interesting points connected with *Sagmatorhina* as compared with the present genus. The opinion relative to the season-

[Jan.

al or sexual character of the horn (page 905, Birds of N. A.)* would probably not have been expressed, had the writer enjoyed the opportunity of examining such an extensive series as have been at command in the preparation of the present monograph.

This species was first named *Alca monocerata* by Pallas in 1811. Prince Bonaparte called it "*Phaleris occidentalis*" in 1827; which name has been usually adopted, Pallas' description being overlooked or disregarded. Brandt appears to have accidentally misquoted Bonaparte's name in calling the bird "*Cerorhina orientalis*, Bp." Eschscholtz called it "*Chimerina cornuta*" in 1829. These are the only synonyms which the writer has been able to collate, except, of course, those resulting from the reference of the bird to diverse genera, as has been already noted.

SAGMATORRHINA, Bonaparte.

Sagmatorrhina, Bonaparte, P. Z. S. Lond. 1851, p. 202. Type *S. Latham*, Bp.

"Bill twice as long as high, upper mandible straight at the base, covered with a very large cere, incurved at the tip; lower mandible ascending immediately beyond the middle, forming an obtuse angle; nostrils linear, marginal."—Bp. l. c.

The above is a translation of the diagnosis of a genus framed by Bonaparte for the reception of a bird he calls *S. Latham*. It apparently differs from *Ceratorhynchus* in the contour of the bill, the presence of a soft cere saddled on the base of the upper mandible in the place of a horn, and, it may be presumed, in the absence of the peculiar accessory corneous element at the mandibular symphysis, as no mention is made of such a character. The type and apparently only known specimen is in the British Museum.

The possession of a soft flat cere in place of an upright horn, and the want of the accessory mandibular piece are precisely the features which characterize *Cerorhina Suckleyi* Cassin; and in fact are about the only ones by which the latter can satisfactorily be distinguished, specifically, from *C. monocerata*. It therefore seems a procedure of obvious propriety to refer *Suckleyi* to the present genus. At the same time *Suckleyi* can by no possibility be confounded with *Latham*; nor is the latter by any means a young *C. monocerata*, as some authors have ventured to hint, and others have boldly assumed. An inspection of the figures accompanying the present memoir ought to set all doubts at rest.

Species—(2.)

- | | |
|---|----------------------|
| "Length 16 inches; wing 7.50; bill 2 long, 1 high, five-eighths wide at the base"..... | 1. <i>Latham</i> . |
| Length 14.50; wing 6.50; bill along culmen 1.30, depth at base .60, width at base four-eighths..... | 2. <i>Suckleyi</i> . |

SAGMATORRHINA LATHAMI, Bonaparte.

??? *Alca labradoria*, Gmelin, S. N. i, pt. ii, 1788, p. 550. Very doubtful.

Rather referable to *Fratercula arctica*, which see.

Sagmatorrhina labradoria, Cassin, Baird's B. N. A. 1858, p. 904.

Sagmatorrhina Latham, Bonaparte, P. Z. S. London, 1851, p. 202, pl. 44.

"Largest among its allies; blackish, beneath pallid fuliginous; bill and feet red; cere and webs black. Length 16 inches; bill 2 inches long, 1 inch high, five-eighths wide at the base, three-eighths in the middle; wing 7½ inches; tail 3½; tarsi 1½; longest toe 2 and 3-eighths inches.

Hab.—"North-west Coast of America.

*Spec. No. 10608, there enumerated, seems to have called forth the remark above alluded to. This specimen, however, is believed to be the adult of *S. Suckleyi*, of which only the young bird was at that time recognized.

"This species is the largest of the subfamily, which is well known to contain the dwarfs of the water birds; it is one-third larger than *Ceratorrhina monocerata*, of which it has precisely the coloring, wanting only (at least in the state we have it) the little white feathers above the eye and at the corners of the mouth. The proportions of the wings, tail, feet and toes are the same; the bill and toes must have been reddish; the cere and membranes black. Like the *Ceratorrhina*, it seems to be confined to the north-western Arctic region of America; and we are led to believe it does not extend to the Siberian shores, from the circumstance of its not having been noticed by Russian naturalists."

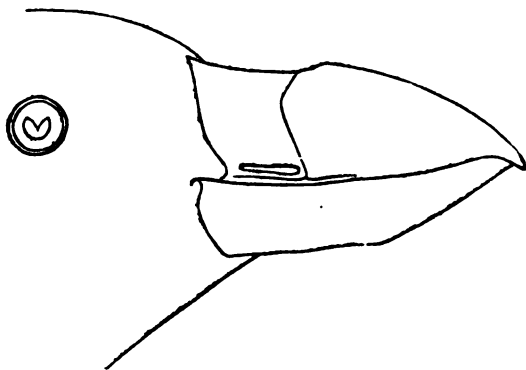


Fig. 3.—*Sagatorrhina Lathamii*, By. Nat. size.

The preceding is Bonaparte's notice of the species, containing all that is known about it by American ornithologists. The writer takes pleasure in acknowledging his indebtedness to Dr. P. L. Sclater, of London, for the accompanying figure, drawn from the type specimen in the British Museum. Dr. Sclater says very positively that the bird is a perfectly valid genus and species, and the figure evidently warrants the assertion. Independently of the difference between the cere and the horn, the shape of the bills of *C. monocerata* and *S. Lathamii* are quite diverse. The dimensions of the latter are much larger than those of the former.

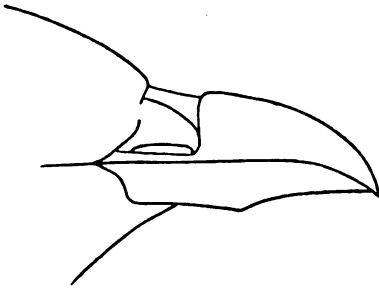
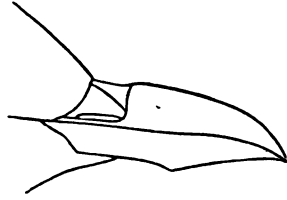
SAGATORRHINA SUCKLEYI, (Cass.) *Coues*.

Cerorhina Suckleyi, Cassin, Baird's B. N. A. 1858, p. 906. Based on spec. No. 4579, Mus. Smiths. Young. Puget Sound. Cooper and Suckley, Pacific R. R. Rep. xii, pt. ii, 1860, p. 284. Refers to same specimen.

American and Asiatic Coasts of the Pacific. Spec. in Mus. Smiths Inst.—Young, (type of the species, Puget Sound;) adult, breeding plumage (San Diego, Cal.) Adult, (Hakodadi, Japan.)

Adult! breeding plumage! (No. 31908,* Mus. Smiths, ♀, San Diego, Cal. Feb. 3, 1862, J. G. Cooper.) "Iris white; bill black and orange; feet pale yellow, black below," (label.) Bill now obscure yellow, the culmen and basal membrane blackish. Feet dull whitish; tarsi behind and feet below blackish; claws black. Colors of the plumage almost precisely as in the adult *monocerata*; white feathers on sides of head exactly the same. Breast rather deeper grayish-ash, the color extending a little further, and more abruptly defined against the white of the other under parts.

* Figured in Elliot's Birds of North America.

Fig. 4.—*S. Suckleyi*, Adult. Nat. size.Fig. 5.—*S. Suckleyi*, Juv. Nat. size.
Cassin's type specimen.

No vestige of a horn at base of upper mandible; this being covered with a soft skin, overlapping the culmen, extending to the nostrils, which open beneath its lower border. That part of the bill occupied by the membrane is depressed below the level of the rest, both on the ridge and sides. The membrane is shrunken and shrivelled in its present state. There appears to have been a slight tumidity, in the fresh state, of this membrane, just on the ridge, which may have elevated it to the level of the rest of the culmen, and which could possibly even have been inadvertently called a "knob" by one who regarded it as the beginning of a horn. No trace of an intercalated piece between the mandibular rami, which have thin, sharp, smooth edges, and come together in a fine point at the symphysis. Bill much smaller, weaker, and particularly less deep at the base than that of *C. monocerata*; but not much shorter, nor comparatively even so much compressed as in the latter bird. Culmen regularly decurved from base to tip; the latter moderately overhanging; rictus at first nearly straight, then gently declinate; gonys nearly straight, slightly concave; outline of mandibular rami about straight.

Decidedly smaller than *monocerata*; the wing comparatively longer. Length about 14.00; "extent 25.50," (label); wing 7.25; tarsus 1.10; middle toe and claw 1.90, outer do. 1.80, inner do. 1.45; bill: chord of culmen 1.30, of which the membranous part is .30; rictus 1.85; gonys .75; depth of bill at base .60; its width at same point .45.

Young. (No. 4579, Mus. Smiths. Fort Steilacoom, W. T. Jan. 8, 1856. Dr. G. Suckley. Mr. Cassin's type of the species, as described l. c.) "Membrane at base of upper mandible grayish dusky black; middle of both mandibles dingy orange, their tips dusky; iris pale hazel; under surface of the webs of the feet, and the posterior aspect of the tarsi dusky black; upper surface of the toes bluish white, darker about the articulations; nails black." (Suckley, l. c.) The colors of the plumage are precisely as described for the young *C. monocerata*; possibly a shade darker, with rather more white on the under parts than in the corresponding age of the other species.

Much smaller than the adult; length "about 12.50; extent 24.00;" (Suckley, l. c.); wing 6.50; tail 2.00; tarsi 1.00; bill along culmen 1.20, of which the membranous portion is .30; along rictus 1.60; along gonys .60; its depth at base .40. The bill is small and slender; its general shape calls to mind the bill of a young gull of one of the smaller species. The several outlines, particularly that of the culmen, are straighter than in the adult; the tip is less decurved. The bill is much longer, relatively and absolutely, than that of the corresponding age of *monocerata*; it is comparatively more slender. There is no trace of a knob;* the membrane has precisely the same characteristics as

* Dr. Suckley (l. c.), speaking of this specimen, uses the word "knob" in connection with it. His expression is to be taken as indicating merely the turgidity of the soft membrane during the life of the bird; which raises the membrane to or above the level of the rest of the culmen. The membrane, being very soft, shrinks and shrivels in drying, and the prominence disappears.

that of the adult bird above described. There is no trace of an accessory piece between the rami.

The bird above described was first indicated as a distinct species by Mr. Cassin in 1858; that gentleman founding his specific characters mainly upon the small size, somewhat darker colors, and much smaller, slender bill, as compared with *monocerata*. The species has always been looked upon with considerable mistrust, and very generally regarded as only a young *monocerata*. At the time of the introduction of *Suckleyi*, *C. monocerata* was not known in all its ages and stages of plumage, as it is at present. The horn which characterizes it was believed to be frequently wanting, particularly in the young bird. The accessory symphyseal piece had not received attention. These facts, together with the almost perfect identity in plumage of the two birds, very naturally led to the suspicion above mentioned; seemingly borne out, too, by the fact that the type of *Suckleyi* was a very young bird, the adult of which was unknown, or at least unrecognized. But it has been shown in the preceding article that indications both of the horn and of the accessory interramal element appear in *monocerata* even before it is fully feathered, and that these two distinguishing features are preserved in all ages, at all seasons, with both sexes. The discovery of *Suckleyi* in perfectly adult breeding plumage settles the question of its identity with *monocerata*. Specimen No. 31,908, above described, has no trace of a horn or accessory symphyseal piece; and is smaller, and otherwise conspicuously different from *monocerata*, though of almost precisely similar colors of plumage.

There is something highly interesting, very singular, and, with our present information upon the subject, totally inexplicable, in the fact that the plumage of the two birds is so nearly identical as not to be satisfactorily distinguished in any particular; while the bills differ in such radical characteristics. The suspicion comes unbidden, that the whole truth in the matter of *C. monocerata*, and *S. Suckleyi*—and *S. Lathamii*, too—remains to be developed; while it is certain, at the same time, that nothing but the truth appears upon these pages.

In the reference of this species to the genus *Sagmatorrhina*, the writer is guided simply by Bonaparte's diagnosis, and by the figure of the head of *S. Lathamii*, kindly furnished by Dr. Sclater. The dimensions of *S. Lathamii* and the form of the bird are sufficient to distinguish *S. Suckleyi* from it.

SIMORHYNCHUS, Merrem.

Alca, Pallas, Spic. Zool. v, 1769, in part; and of some authors.

Uria, Pallas, Zoog. R.-A. ii, 1811, in part.

Lunda, Pallas, Zoog. R.-A. ii, 1811, in part.

Simorhynchus, Merrem, ———, 1819. Type *Alca cristatella*, Pall. Fide G. R. Gray. (Where is this genus named?)

Phaleris, Temminck, Man. Orn. ii, 1820. Type *Alca psittacula*, Pallas. (Also includes *cristatella*.) And of most authors.

Mormon, Lichtenstein, 1823, in part. (*M. superciliosa* = *camtschatica*, Lep.)

Ombria, Eschscholtz, Zool. Atlas, 1831. Type *Alca psittacula*, Pallas.

Cyclorrhynchus, Kaup, 1829. Type *Alca psittacula*, Pall. Fide G. R. Gray.

Tylorhamphus, Brandt, Bull. Acad. Imper. St. Petersburg, ii, 1837. Type *Alca cristatella*, Pall.

Ciceronia, Reichenbach, 1853. Type *Phaleris microceros*, Brandt.

Of moderate and very small size; general form stout. Usually with a crest, or with elongated feathers about the head. Bill variable: sometimes simple, oftener irregular in form, with various elevations and depressions, often with nodules or other accessory elements; always stout, compressed, shorter than the head, the culmen very convex, the tip acute. Nostrils entirely unfeathered. Wings and tail of the ordinary shape and length. Feet small and short; tarsus compressed, entirely reticulate, shorter than the middle toe. Toes long, outer and middle about equal in length, the claw of the latter largest. Claw

[Jan.

of inner toe reaching base of middle one. Claws much arched, compressed, acute, the inner edge of the middle one scarcely dilated.

The genus as above defined is framed to include a number of species, all more or less closely allied, yet presenting differences from each other in form in almost each instance. The various species are all nearly identical in the structure of the wings, feet and tail; in the bill no two entirely agree. Each presents *sua speciei* characters in the shape of the bill; but the very fact that this organ varies so much seems to indicate that the differences are no more than of specific consequence. A glance at the synonyms above adduced will show what forms have been made indicative of genera. *Pittacula* is perhaps the species which has been most generally separated from the others, in view of its oval upper, and falcate under, mandible. But if this bird is to be generically distinguished, so also must *crisatellus*; for the latter differs in still greater degree, in the presence of an anomalous accessory element in the bill. This one being taken out, what to do with *camtschaticus*, so very closely allied? It is almost identical with *crisatellus* in all points of structure, except in the details of the configuration of the bill, and in these points it stands intermediate between this species and some others. Then *microceros* and *pusillus* would have to stand by themselves. So also would *tetraculus* and *Cassini*. These two, particularly, differ more from all the rest, in their short, simple conic bills, than any of the rest do from each other. In fine, if *pittacula* be allowed generic rank, so also must *crisatellus*, and *pari passu* must no less than three more genera be recognized. It seems much the most philosophical to group all these forms together in a single genus, regarding the differences in the bills as specific.

In such an acceptation, the genus comprises eight species, which may be thus analysed:

Species—(8.)

- I. *Phaleris* Temm. Upper mandible oval, under mandible falcate; rictus curved upwards. No crest.
Blackish; white below from the breast; a white spot below the eye..... 1. *pittaculus*.
- II. *Simorhynchus*, Merrem. Upper mandible triangular, under mandible nearly straight; rictus horizontal, sinuate. A long recurved crest.
Angle of the mouth with a supernumerary corneous piece. Sides of under mandible unfeathered. One series of white feathers on the head 2. *crisatellus*.
Unknown. (See Pallas' description, *infra*)..... 3. *dubius*.
Angle of mouth without a supernumerary piece.
Sides of under mandible feathered. Three series of white feathers on head... .. 4. *camtschaticus*.
- III. (*Unnamed subgenus*.) Bill very small, short, conic, simple, destitute of any irregularities whatever.
Large; bill moderately compressed; a long recurved crest; fuliginous black above, fuliginous gray below. Wing 5·50; rictus ·70; width of bill at base ·30; tarsus, middle toe and claw together 2·50..... 5. *tetraculus*.
Small; bill excessively compressed; no crest (?); uniform plumbeous, lighter below, whitish on the abdomen. Wing 4·25; rictus ·60; width of bill at base ·151 Tarsus, middle toe and claw together, 2·00..... 6. *Cassini*, *n. s.*
- IV. (*Ciceronia*, Reich.) Smallest of the genus. Short white hair-like feathers over the forehead.

1868.]

Length about 6.50; height of bill at base .30. Upper mandible with a basal knob; bill stout and wide for its length. No decided white patch on scapulars 7. *microceros*.

Length about 5.50; height of bill at base .20. Upper mandible without a knob; bill slender and narrow for its length. Conspicuous white patch on scapulars 8. *pusillus*.

The first distinctive name of this genus is said, by Mr. Gray, to be *Simorhynchus* of Merrem, with *crisatellus* as type. This genus is not in general employ. The present writer does not know where it is instituted, but adopts it upon the authority just mentioned. *Phaleris* of Temminck is usually adopted. This genus was framed, in 1820, to include both *psittaculus* and *crisatellus*: the characters as laid down apply best to the latter; the former is mentioned first. It cannot be used for *crisatellus*, however, being antedated by Merrem's name. If *psittaculus* is separated from the present genus, it must be called *Phaleris*, Temm., which antedates *Ombria* Esch., though the latter is usually applied to that bird. *Tylorhynchus* Brandt is simply a duplication of Merrem's genus; *Cyclorrhynchus* Kaup merely repeats Temminck's. *Cuceronia* Reichenbach is based upon the smallest species of the genus—section four in the preceding analysis. Section three of the foregoing synopsis, comprehending *tetraculus* and *Cassini*, is really the most distinct of any, and is the best entitled to generic rank. The chance to run in a name is left open to any one who may be ambitious in that line.

SIMORHYNCHUS PSITTACULUS, (Pall.) Schl.

Alca psittacula, Pallas, Spic. Zool. v, 1769, p. 13, pl. 2, and pl. 5, figs. 4, 5, 6. Gmelin, S. N. i, pt. ii, 1788, p. 553. (Based on Pallas and Pennant.) Latham, Ind. Orn. ii, 1790, p. 794. (Same basis.) Donndorff, Beytr. Zool. ii, pt. i, 1794, p. 822. Quotes Steller, Nov. Act. Petrop. iv, p. 426, pl. 13, figs. 25, 26; and other authorities.

Lunda psittacula, Pallas, Zoog. R.-A. ii, 1811, p. 366, pl. 84.

Phaleris psittacula, Temminck, Man. Orn. i, 1820, p. 112. Stephens, Shaw's Gen. Zool. xiii, 1825, p. 44. Bonaparte, Synopsis, 1828, p. 426. Gray, Genera Birds, iii, 1849, p. 638. Bonaparte, Comptes Rendus, 1856, xlii, p. 774.

Ombria psittacula, Eschscholtz, Zool. Atlas, 1831, iv, p. 3, pl. 17, Brandt, Bull. Acad. St. Petersb. ii, 1837, p. 348. Cassin, Baird's B. N. A. 1858, p. 910. Elliot, B. N. Am. 1866, part i.

Simorhynchus psittaculus, Schlegel, Urinatores Mus. Pays-Bas, 1867, livr. ix, p. 24.

Asiatic and American coasts of the North Pacific; Aleutian Islands; Kamtschatka, (Mus. Acad. Philada.); Russian America, (Mus. Smiths. Institution); Behring's Sea, (Schlegel, Mus. Pays-Bas.); Japan?

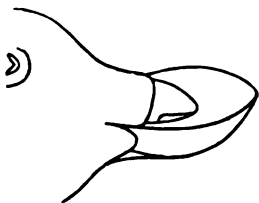


Fig. 6.—*Simorhynchus psittaculus* (Pall.)
Nat. size.

Bill moderately large, much compressed, densely feathered for some distance at base of upper mandible and sides of lower. Upper mandible almost perfectly oval in its lateral aspect, its culmen gently curved, and its tomial edges more decidedly convex, the former descending, the latter rapidly ascending to meet at an obtuse angle. Lower mandible extremely slender, falciform in shape, strongly curved upwards, its tip very acute, its tomial edges concave, corresponding to the convex tomia of the upper mandible; the gonys much and regularly curved. Nasal fossæ long and wide, but rather shallow; the nares rather broadly linear, or narrowly oval, overhung by a slightly projecting scale. Frontal feathers embracing culmen

[Jan.

in a slightly reëntrant angle, thence descending about perpendicularly to the very edge of the upper mandible. Feathers on side of lower mandible not extending quite so far as those on side of upper. Interramal space fully feathered, but in consequence of the peculiar shape of the rami, there is a small pit or fossa between them, just at their junction, which is unfeathered. Wings and tail of the usual length and shape; the length of the latter contained about three and two-thirds times in the length of the former from the carpal joint to the end of the longest feather. Tarsus shorter than the middle toe without its claw.

Adult—Without a crest. A series of elongated very slender filamentous white feathers from the eye backwards and downwards, white. Entire upper parts, with chin, throat, breast, and flanks, fuliginous or brownish-black, lighter or grayer below than above; other under parts pure white, pretty trenchantly defined against the darker color of the breast. Bill orange or coral red, becoming enamel yellow at the tip, and along the cutting edges. Legs and feet dull greenish, darker posteriorly, (in the dried state.)

The above is the state of plumage of apparently most mature birds; but is much more rarely met with than the succeeding: Upper parts as just described, but no whitish feathers below and behind eye. Entire under parts white, marbled on the throat, breast and sides with dusky or blackish; this color usually occupying chiefly or wholly the tips of the feathers, whose bases are white. The mottling is thickest on the breast, most sparse on the abdomen; but it varies in degree with almost every specimen. A state of plumage is described as that of the young, in which the white occupies nearly the whole under parts, and is scarcely mixed with dusky, even on the throat and breast. This stage is not represented in American Museums. The tendency of the mottling, as the bird grows older, seems to be to increase on the throat, breast, perhaps on the sides and flanks, and to disappear from the other under parts, leaving the latter pure white, in marked contrast. The under wing coverts are always dark ashy brown; the short tibial feathers the same.

Length about 9.00; wing 5.40 to 5.75; tail 1.50 to 1.60; tarsus (average) 1.00; middle toe 1.10. Bill: chord of culmen .60, chord of gonys just about the same; depth opposite posterior end of nostrils .45; width at same point .30; rictus nearly or about 1.00.

This very curious species may be instantly recognized, in whatever state of plumage, by the remarkable configuration of the bill; the rictus being strongly curved upwards, the upper mandible oval, obtuse, the lower falciform, acute. It is one of the longest and best known of the North Pacific representatives of the family, and is apparently a very common bird, though specimens do not occur in collections so often as might be expected. It seems to be decidedly boreal in habitat, and is not recorded, on the American coast, so far south as the United States, though occurring at Sitka, R. A., and probably off the coast of British Colombia. It has no specific synonyms, though it has been referred to several different genera. It is one of Dr. Pallas' species. It is the type of M. Temminck's genus *Phaleris*.

SIMORHYNCHUS CRISTATELLUS, (Pall.) Merrem.

Alca cristatella, Pallas, Spic. Zool. v, 1769, p. 20, pl. 3, and pl. 5, figs. 7, 8, 9. Gmelin, S. N. i, pt. ii, 1788, p. 552, No. 7. Latham, Ind. Orn. ii, 1790, p. 794, No. 6. Donndorff, Beytr. Zool. ii, pt. i, 1794, p. 821. Vieillot, Gal. Ois. ii, 1825, p. 242, pl. 297.

Uria cristatella, Pallas, Zoog. R.-A. ii, 1811, p. 370, pl. 86. Erroneously cites as synonymous *Alca camtschatica*, Lepechin.

Simorhynchus cristatellus, Merrem., Bonaparte, Tab. Comp. Pelag. Comptes Rendus, xlii, 1856, p. 774. Schlegel, Urinatores Mus. Pays-Bas, livr. ix, 1867, p. 25. (Considers *U. dubia* and *tetracula* Pall., young of this species.)

Phaleris cristatellus, Stephens, Shaw's Gen. Zool. xiii, 1825, p. 47, pl. 5. Not 1868.]

of Temminck, Pl. Color. 200, which is *Alca camtschatica* Lepechin. Bonaparte, Synopsis, 1828, p. 428.—Id. Compt. and Geog. List. 1838, p. 66. Vigors, Zool. Voy. Bloss., 1839, Orn. p. 33. Gray, Gen. B. iii. 1849, p. 638. *Phalaris (Simorhynchus) cristatella*, Cassin, Baird's B. N. A. 1858, p. 906. *Tylorhamphus cristatellus*, Brandt, Bull. Acad. St. Petersb. ii, 1867, p. 348. *Phalaris superciliosa*, Audubon, Orn. Biog. pl. 402; oct. ed. pl. 437. Not *Mormon superciliosa* Licht., nor *Phalaris superciliosa* Bonap., which refer to *Alca camtschatica* Lepechin.

Asiatic and American coasts and islands of the North Pacific, to Behring's Straits; perhaps into the Arctic Ocean. Kamtschatka and Behring's Straits, (Mus. Acad. Phila.) Japan, and north-west coast of America, (Mus. Smiths. Inst.) Not known to occur on the American coast so far south as Washington Territory, U. S.



Fig. 7.—*Simorhynchus cristatellus*, (Pallas.)
Nat. size.

from base to tip, which latter is rather acute, and slightly overhangs the lower mandible; its tomial edge extremely sinuate and irregular, lightly notched just behind the tip, at the base widened and somewhat everted, for the reception of the cutting edge of the lower mandible; lower mandible not nearly so deep as the upper, somewhat ascending towards the tip, which latter is slender and acute; the gonys short, perfectly straight, moderately ascending, the sides of the lower mandible elongated, everted, their tomial edge elevated and dilated at the base, posteriorly corresponding in contour to the antero-inferior outline of the supernumerary piece. The latter is a sub-circular or subquadrate corneous plate, slightly concavo-convex, wedged in between the bases of the tomial edges of the two mandibles, and forming the angle of the rictus; in color and texture it resembles the rest of the bill, of which it is a true component element. Nasal fossæ small and inconspicuous, not deeply furrowed, filled in by corneous substance like the rest of the upper mandible; the nostrils small, short, linear-oblong, placed close by the tomial edge of the mandible, overhung by an arched and much dilated corneous scale. Feathers extending on culmen to a point opposite the angle of the gonys, thence descending perpendicularly along the sides of the bill, just past but not touching the posterior extremity of the nostrils; thence following the sinuities of the commissural edge of the upper mandible to the supernumerary piece, and around the border of the latter,* but not encroaching upon it. Interramal space of lower mandible densely feathered; but no feathers encroach upon the sides of the lower mandible, contrary to the usual rule in this group.

* This supernumerary corneous element is not attached by its whole surface to the sub-cumt bone; but a part of its upper border is free and projects a little away from the skull. The fossa down behind this free raised border is fully feathered.

Wings and tail of the usual shape and structure of this group; the length of the latter contained three and a half times in the length of the former from the carpal joint to the end of the longest primary. Legs short, stout, little compressed. Tarsus entirely reticulate, shorter than middle toe without claw; outer toe as long as the middle one; its claw shorter and smaller than that of the middle one. Inner lateral toe extremely short, the tip of its claw falling far short of the base of the middle claw.

Adult.—An elongated crest of twelve to twenty slender feathers springing in a bundle from one point at the extreme forehead, far in advance of the angle of the rictus, and curving over forwards in the greater part of a circle. These feathers are not truly filamentous, having well developed, though short barbs, and appear narrower than they really are, from the slight obliquity of the barbs from the shaft. A slender bundle of filamentous feathers from the posterior canthus of the eye over the auriculars and sides of the neck. A very few shorter filamentous feathers forming a sparse interrupted superciliary series. All these filamentous feathers white or whitish; the crest concolor with the plumage of the upper parts. General color of the crown, nape, wing, tail, and whole upper parts glossy blackish, with a good deal of a fuliginous or brownish (not plumbeous or cinerous) tint; under parts a diluted shade of the same, or much more brownish gray, tending on the abdomen and posterior under parts generally to ashy gray. Under surfaces of wings and tail like abdomen. Bill and appendages orange or vermillion red, yellowish towards the tip. Feet dusky greenish, an undefinable color, in the dried state.

Length about 9·00; wing 5·25; tail 1·50; tarsus 9·00; middle toe and claw 1·35; outer toe and claw about the same, or slightly less; inner toe and claw 1·00; bill: chord of culmen ·45; tomia of upper mandible, excluding supernumerary piece ·70; greatest width of the latter ·25; tomia of under mandible ·90; gonys ·40; depth of bill opposite posterior end of nares ·45; width at same point ·35.

Young.—Similar to the adult, except in the following points:—The bill is smaller, weaker, less irregular and sinuous in outline, less brightly colored, wanting the expansion and eversion of the tomial edges of the two mandibles near their base, and with little or no trace of the supernumerary piece at the angle of the mouth. Even in the youngest specimens the bill shows unmistakable signs of its future character, and cannot be confounded with the simple conic bill of *tetraculus*, etc. The crest and white setaceous feathers are wanting, or only traces of them are apparent. The color is less blackish, more inclining to a fuliginous dusky above, and to a light dull brownish gray below.

This species never acquires a distinct parti-coloration like that of most species of the genus. With the exception of the whitish filamentous feathers on the head, the colors are uniform over the whole body, varying in shade on different parts; and the transition from the darkest, that of the upper parts, to the palest on the lower is effected by imperceptible degrees. The brilliantly colored bill is a conspicuous feature. The color of the feet cannot be accurately defined in the dried state; but the tints are probably not very striking. The crest only makes its appearance after the bird is full grown, is at least nearly a year old, and has acquired pretty much the perfect shape of the bill. The same is true of the white supra- and post-ocular filaments; and generally among the Phaleridine birds, the presence of these peculiar head-ornaments may be relied on as indices that the bird is adult, and that its bill has acquired its mature form. It is just possible, however, that these remarks may not apply to the setaceous frontal feathers of *S. microceros* and *pusillus*. The crest of *S. cristatellus* first appears as a little bundle of short straight feathers shooting out backwards from the plumage of the forehead. These plumes, in an early state of their growth, are much broader,

that is, with more distinct barbs or fibrillæ, than subsequently; considerable time elapses before they begin to curl over forwards, and they may continue straight until they are an inch or rather more in length. When full grown, they are nigh unto two inches long, curve until they almost make a circle, drooping gracefully, helmet-wise, upon the bill itself. The crest of this and other species is doubtless moved by peculiar muscles, and entirely subject to the control of its wearer, like the very similar crests of the birds of the genus *Lophortyx*.

Simorhynchus camtschaticus is obviously the species most likely to be confounded with the present. In fact, such has been its fate at its hands of so distinguished an ornithologist as M. Temminck. It would be wasting words to institute a comparison between the adults of the two species at this late day. In the youthful condition, before the distinctive head-ornaments are apparent, and even before the bill has attained its perfect form, so characteristic in each case, the two species may be distinguished with equal facility. In *camtschatica*, the basal moiety of the sides of the lower mandible is always feathered; in *crisatellus* this part of the bill is in its whole length always perfectly bare of feathers. This latter feature is, in fact, the most excellent diagnostic character of *crisatellus*; by the aid of which alone the species may always be recognized, be it in never so immature condition, with never so undeveloped a bill. The relationships of this species to *dubius* and *tetraculus* need not be noticed here, as they are given in all necessary detail under the head of these species respectively.

This species was introduced into the records in 1769, by Dr. Pallas, who fortunately gave it a binomial name, thereby securing it from appropriation by Gmelin, who contrived to fitch so many species from Pennant, Latham, and other contemporaneous writers. Dr. Pallas first described it as an *Alca*, but afterwards removed it to the genus *Uria*—a very unwarrantable procedure. It is the type of Merrem's genus *Simorhynchus*, and of Brandt's genus *Tylorhamphus*; but not, as generally supposed, of Temminck's genus *Phaleris*, which is based upon *Alca pinnacula* Pall. Though thus referred to so many different genera, it has hardly a specific synonym, unless the name on Audubon's plate 402 be regarded as such.

Numerous excellent specimens of this bird are in the collections of the Philadelphia Academy and of the Smithsonian Institution, from the various localities quoted at the head of this article. It is decidedly a boreal species, not recorded from the coast of the United States, though occurring on the Asiatic shores as far south, at least, as Japan.

SIMORHYNCHUS DUBIUS, (Pallas) Coues.

Uria dubia, Pallas, Zoog. R.-A. ii, 1811, p. 371, pl. 87. "U. rostro fusco simplici, crista frontis pennacea recurva, * * sexu vel ætate tantum præcedente [*crisatella*] videtur deferre, licet deficientes ad oris angulos calli carnei, et rostrum minus hiulcum differentiam insignem constituent. Cum præcedenti in mari extra Awatscham portum observatur. Irides candidæ. Rostrum sanguineo-fuscum. Pedes coerulescentes. Cæterum *A. crisatellæ* magnitudine et colore simillima."

Phaleris dubia, Brandt, Bull. Acad. St. Petersb. ii, 1837, p. 347. Gray, Gen. Birds, iii, 1849, p. 638.

Tylorhamphus dubius, Bonaparte, Tab. Comp. Pelag. Comptes Rendus, 1856, xlii, p. 774.

This species, if it be really such, appears appropriately named, since there is nothing to distinguish it from *crisatellus* beyond certain differences in the bill which might with propriety be attributed to an immature condition of the specimen upon which the species was based. And yet the mention of a recurved crest of feathers upon the forehead by Dr. Pallas militates against the supposition that his specimen was not adult. The great reliability which the scientific writings of Dr. Pallas claim, and justly deserve, from their

[Jan.

uniform excellence and accuracy, necessitates no small degree of caution in a decision against the validity of one of his species. It will be evident upon the least reflection that, for example, such a perfectly valid species as *tetraculus*, might be so described, in a few sentences, that no striking impression of its difference from *cristatellus* should be conveyed. It is also to be borne in mind that Prof. Brandt, probably unsurpassed by any one in the accuracy and extent of his knowledge of the *Alcidae*, and particularly well fitted to judge of Dr. Pallas' works, admits the species in question as distinct. And in the present instance it seems preferable to coincide with the views of these naturalists, and to allow the species to hereafter stand upon its own merits, until the proof that it has none is forthcoming, notwithstanding Dr. H. Schlegel's summary assignment of it (as well as of *tetraculus*) to *cristatellus*.

There is no specimen purporting to represent this species in any American Museum; and the only information regarding it which can be furnished at present writing is embodied in the above citation from the "Zoographia." It is hardly, if at all, noticed by other writers than those here cited. Mr. Cassin, however, queries it as a synonym of *cristatellus*.

SIMORHYNCHUS CAMTSCHATICUS, (Lepech.) Schl.

Alca kamtschatica, Lepechin, Nova Acta Petrop. xii, 1801, p. 369, pl. 8.

Phaleris camtschatica, Brandt, Bull. Acad. St. Petersb. ii, 1837, p. 347. Gray, Gen. Birds, iii, 1849, p. 638. Cassin, Baird's B. N. A. 1858, p. 908.

Tylorhamphus camtschaticus, Bonaparte, Tab. Comp. Pelag. Comptes Rendus, 1856, xlii, p. 774.

Simorhynchus camtschaticus, Schlegel, Urin. Mus. Pays-Bas, 1867. livr. ix, p. 25.

Uria mystacea, Pallas, Zoog. R.-A. ii, 1811, p. 372, pl. 89. Quotes *Alca camtschatica* Lepechin, having just previously cited it for *cristatella*.

Phaleris cristatella, Temminck, Pl. Color. No. 200. Not of authors.

Mormon superciliosum, Lichtenstein, Verzeich. 1823, p. 89.

Phaleris superciliosa, Bonaparte, Comp. and Geog. List, 1838, p. 66.

North Pacific Coasts. Unalaschka, (Pallas.) Kamtschatka, (Mus. Bost. Nat. Hist. Soc.) North-west coast of America, (Mus. Smiths. Inst.)

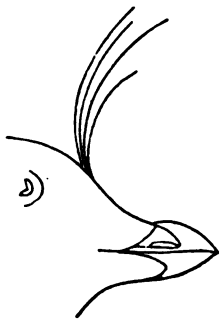


Fig. 8.—*Simorhynchus camtschaticus*, (Lep.) Nat. size.

much shorter than middle toe and claw; middle toe a little shorter than outer toe; middle toe and claw just as long as outer toe and claw; inner toe and claw a little shorter than middle toe without its claw.

The form of the bill alone is characteristic; the other details of structure are shared by the rest of the *Simorhynchi*.

A very long recurved crest of exceedingly slender, delicate, filoplumaceous 1868.]

Bill much smaller, simpler, and differently shaped from that of *S. cristatellus*, though not distantly resembling the juvenile undeveloped condition of the latter. Width at nostril very slightly less than depth at same point, about two-thirds of the length of culmen; bill regularly > shaped in lateral outline; culmen very convex, regularly arched from base to tip; gonys nearly straight, rapidly ascending; commissure slightly sinuate, a little curved upward at tip; apices of both mandibles acute, fairly meeting each other on the level of the commissure; tomia of upper mandible slightly nicked near the tip of the bill. Wings and tail of usual shape for this genus; the length of the latter contained about three and a half times in the length of the former from the carpal angle to end of first primary. Tarsus

feathers, six (to ten?) in number, springing from the anterior part of the forehead, about opposite the anterior edge of the orbits, brownish-black; a single series of slender filamentous feathers from each side of the base of the culmen, and thence to the superior border of the orbit; a second similar but shorter series from the edge of the commissure, and thence along the lower part of the side of the jaw; a third similar series from the posterior canthus of the eye, and thence adown the side of the neck; yellowish white. Body colors almost uniform; brownish black, sometimes with more of a grayish, sometimes with more of a fuliginous hue; the wings and tail most intense in color, frequently nearly black; the under parts, particularly the belly, lighter and more grayish brown, inclining to mouse color. Bill orange red, its apex salmon color, or more decidedly yellowish. Legs (in the dried specimen) posteriorly dark brown, anteriorly lighter, more reddish-brown; feet dull brown; claws reddish-brown.

Length of body (approximately) 8.00 inches; wing 5.60; tail 1.60; bill: chord of culmen .45; depth at base .28, width at base nearly the same; length of rictus .95; tarsus 1.00; middle toe 1.25, its claw .35; outer toe 1.30, its claw .30; inner toe and claw 1.10; length of outstretched crest 1.40; length of longest whitish feathers over eye 1.00.

Os hyoides examined: The apophyses are slender cylindrical bones .6 long, slightly knobbed at the end, devaricating at an angle of about 40°. The ceratohyals are absent in the specimen. The urohyal is a delicate stylet .10 of an inch, then suddenly expands into a broad, flat, very thin spatulous lamina, subrectangular in shape, or rather cordate, transversely concavo-convex. This lamina is as long as the rest of the urohyal, and its breadth is rather greater than the length of the stylous portion. The basi-hyal is .15 of an inch long, slender and cylindrical; bearing upon its apex an exceedingly thin, expanded, somewhat cochleariform glosso-hyal. No opportunity has presented itself of examining the tongue bones of other species of the family.

The present is a long and well known species. First made known, at the beginning of the present century, by Lepechin, (see above) it was redescribed as *Uria mystacea*, in the *Zoographia Rosso-Asiatica*, by Dr. Pallas, whose expression " * * pennulis setaceis albis elongatis superciliaribus mystaceisque," leaves no room for doubt as to the species he had in view. It was redescribed in 1823 by Prof. Lichtenstein, under the name of *Mormon superciliosum*. Unfortunately, it furnished the subject of Planche Colorée, No. 200, at the hands of M. Temminck, under the palpable pseudonym of *Phalaris cristatella*; which event might have been the occasion of confusion and uncertainty, were the bird a less strongly characterized species. As it is, there is no difficulty in detecting and correcting M. Temminck's error. *S. camtschatica* is so very distinct from *cristatella*, that no special comparisons of the two are required. It is only necessary to point to the configuration of the bill, and the presence of superciliary and maxillary filoplumes, for their ready discrimination. For the rest, the present is a much smaller species than *cristatellus*; and the plume is perhaps longer, certainly less recurved, usually composed of fewer feathers, which are rather more filamentous. The setaceous feathers are essentially arranged, as may be seen above, in three distinct sets or bundles; one from the side of the bill along the commissure and lower part of the cheeks; one from the culmen over the eye, and a third from the posterior canthus of the eye backwards over the auricular region and side of the neck; though the first and last sets may appear more or less directly continuous with each other. It is possible that the plumage described above may not be the most perfect one; still, the perfect development of the crest and other ornaments warrants the belief that the bird from which it was taken is an adult. Authors speak of the under parts, particularly the abdomen, as being frequently nearly white; which may be the coloration of those parts in very mature or very old birds.

[Jan.

At present writing only one perfect specimen of this species is known to exist in any American Museum. The Boston Natural History Society possess this one; No. 9209 of the Museum Register, No. 8135 of the Fresnaye collection, now owned by the Society. The Smithsonian Institution has a mutilated specimen, (ah ead only), from the north-west coast of America, presented by Mr. John Gould. As far as can be judged, it belongs to a bird rather more perfectly plumaged than the Boston Society's specimen.

SIMORHYNCHUS TETRACULUS, (Pall.) Coues.

Alca tetracula, Pallas, Spic. Zool. v, 1769, p. 23, pl. 4, and pl. 5, figs. 10, 11, 12. Gmelin, S. N. i, pt. ii, 1788, p. 552, No. 8. Quotes Dusky Auk, Pennant, Arct. Zool. ii, p. 515, No. 435. Latham, Ind. Orn. ii, 1790, p. 794, No. 7. Quotes Pallas, Spic. Zool. Donndorff, Beytr. Zool. ii, pt. i, 1794, p. 821.

Uria tetracula, Pallas, Zoog. R.-A. ii, 1811, p. 371, pl. 88.

Phaleris tetracula, Stephens, Shaw's Gen. Zool. xiii, 1825, p. 46. Brandt, Bull. Acad. St. Petersburg, ii, 1837, p. 347. Gray, Genera Birds, iii, 1849, p. 638. Elliot, B. N. A. 1867, part iii.

Tylorhampus tetraculus, Bonaparte, Tabl. Comp. Pelag. Comptes Rendus, 1856, xlii, p. 774. Erroneous assignment of Brandt's genus *Tylorhampus*, which is based upon *crstatellus*.

Phaleris (Tylorhampus) tetracula, Cassin, Baird's B. N. A. 1858, p. 907.

Asiatic (and American?) coasts of the North Pacific. "In mari orientali, præsertim Unalashka," (Pallas.) Kamtschatka, (Mus. Acad., Philada., and Mus. Smiths. Inst.) Bay of Yedo, Japan, (Mus. Smiths. Inst.)

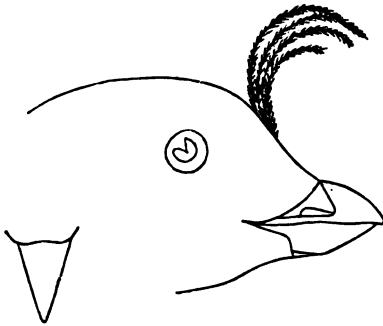


Fig. 9.—*Simorhynchus tetraculus* (Pall.) Nat. size.

Bill small, short, much compressed, regularly conical from a lateral view, simple, being without decided sulci, ridges, caruncles or other irregularities of surface of any sort; culmen narrow, regularly moderately convex from base to tip; commissure and gonys perfectly straight in their whole length; the tip of the bill turned neither up nor down, but the points of both mandibles almost meeting on the level of the commissure. Nasal fossæ scarcely discernible as such, the upper border of the small, basal, linear nostrils being flush with the rest of the bill. Frontal feathers extend forward with an obtusely rounded outline on the culmen, then rapidly recede backwards as they pass downward in a straight line just past the posterior end of the nostrils to the commissural edge of the upper mandible; those on the side of the lower mandible extending not quite so far, but the interramal space fully feathered. Wings rather longer than usual in this group; legs, feet, and tail as in other species of the genus, the legs perhaps a little longer, comparatively, than in other species. A crest of ten or more slender elongated feathers with loosened fibrillæ springs from the middle of the forehead, just before the eyes, and curves forward in the greater part of a circle to near the tip of the bill. A very few filamentous feathers on the sides of the head, the slender series beginning at the posterior canthus, and thence extending downwards and backwards. A small white spot just below the eye. Everywhere dull blackish, or dusky; deepest on the back, becoming more of a smoky or brownish-gray 1868.

on the under parts; under wing coverts like the rest of the under parts; crest colored like the back. Bill an undefinable dusky* in the dried specimen; legs and feet livid gray, (probably greenish or bluish in life); membranes black; claws black.

Dimensions.—(Spec. in Mus. Acad., Phila.) Length about 8.50; wing 5.50; tail 1.60; chord of culmen .35; gape .60; gonys .25; greatest height of bill .33, greatest width .25; tarsus 1.00; middle toe and claw 1.50, outer 1.40, inner 1.25.

Another specimen, (No. 22,258, Mus. Smiths. Inst.) Wing 5.60; tail 1.75; chord of culmen .40; gape .80; gonys .40; height at base of bill .40; width at same point .30; legs and toes as in the preceding specimen.

Three specimens of this species examined: one in the Philadelphia Academy from Kamschatka, which served as the subject of Mr. Cassin's description in the "Birds of North America;" another in the Smithsonian Institution, (No. 22,258,) received from the Bremen Museum, labelled "*Phaleris cristatella*, (Pall.); Winterkleid; Kamschatka;" another also in the Smithsonian, (No. 15,805,) labelled "*Phaleris cristatella*; Bay of Yedo, Japan; Apr. 1854; eye gray; iris black; Rodgers' North Pacific Exploring Expedition." The last mentioned specimen is in a very poor state of preservation, and is a young bird, as evidenced by the short straight crest, directed backwards; though the bill is nearly perfect in size and shape, and the general aspect of the bird is precisely that of the adult. The other two specimens are in fine condition, and represent the perfectly mature state. These three include all that are known to exist in any American Museum. It is not a common bird in collections, and is frequently mistaken for the young *cristatellus*, to which species, however, it bears only a distant and superficial resemblance.

The bird here described is indubitably the "Dusky Auk" of Pennant, a species more perfectly and satisfactorily described and figured by Dr. Pallas as *Alca tetracula*. It is a strongly marked species, not distantly allied to, and somewhat resembling *cristatellus* in everything but the bill, which is of a radically different formation, as will be impressed upon the mind by a perusal and comparison of the descriptions given under head of these species. *Tetraculus* requires no special comparison with *cristatellus* or with *camtschaticus* for the substantiation of its distinctness. *S. Cassini* of this paper is the most closely allied species, and might just possibly be confounded by a careless or ignorant observer. The differences will be found under head of the latter.

The diagnostic points of this species lie chiefly in the small size and peculiar shape of the bill (cf. descr.); the length of the wings, proportionally greater than in any other species of the genus; and the greater length of the feet and toes. The wings, tail, feet and toes are about of the same absolute dimensions as those of *cristatellus*, although *tetraculus* is rather a smaller bird. The various shades of the dark color of the plumage are produced by admixture of black, brown and gray; there is no pure cinereous or plumbeous on any part of the plumage.

This is a species which entered at a very early day into ornithological literature, notwithstanding which it has not a single accredited synonym. Its claims to recognition as a valid species, distinct from *cristatellus*, have not been impugned, except by the learned Director of the Museum of the Pays-Bas. It has been the occasion of no confusion or conflict of opinion among writers, except in those few instances in which it has been erroneously supposed to have furnished the subject of Audubon's plate of *cristatellus*. The most cursory examination of the plate will convince the mind upon this point. Mr. Pennant, in virtue of his "Dusky Auk," which is this species, would have been entitled to the proprietorship of the bird, had he given it a binomial name; but as it is, Dr. Pallas stands as its lawful sponsor, having christened it *Alca tetracula* in 1769.

* Pallas gives its color as "fusco-rubrum;" Gmelin, as "ex fusco-lutescens;" Latham, as "luteo-fuscum."

SIMORHYNCHUS CASSINI, Coues, n. sp.*Phaleria Cassini*, Coues, mss.

DIAG.—S. rostrum parvo, breve, valde compresso, longitudine vix altitudinem excedente, latitudine dimidii altitudinis; ferè triangulare a spectu laterale; simplex, nec ullis additamentis corneis instructo; culmine leviter declinato-convexo, rictu recto, carinà ferè rectà, a scendente; suprà nigro-plumbeus, vertice, alis caudâque nigerrimis; subtus griseo-plumbeus, abdomine crisosque sensim albicantibus; longitudo tota corporis 7.75 (poll. Ang.); alae 4.25; caudæ 1.40; tarsi .80; digiti medii cum ungue 1.20; rostri .40, alt. .30, lat. .151 rictûs .60.

Typical and unique specimen, No. 46,564 of the Smithsonian Museum; a male (adult?) collected Aug. 3, 1866, at Ounimak Pass, Russian America, by W. H. Dall.

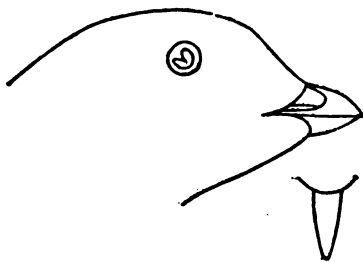


Fig. 10.—*Simorhynchus Cassini*, nov. sp. Nat. size.

separated by a ridge from the commissural edge of the upper mandible; nostrils low down in the fossa, small, short, narrowly linear. Frontal feathers laid straight across the base of culmen, descending nearly perpendicularly along the posterior edge of the nasal fossæ, just attaining the posterior end of the nostrils, then retreating obliquely backwards and downwards. Feathers on side of lower mandible extending to a point opposite those on culmen; somewhat further into the interramal space, which is densely feathered. Wings and tail of usual size and shape. Feet small, tarsi moderately compressed, much shorter than the middle toe and without its claw; only two-thirds the middle toe and claw; outer toe as long as, or slightly longer than the middle, its claw much smaller than that of the middle; tip of inner claw just reaching base of middle claw.

Entire upper parts blackish-cinereous, or very dark lead color, deepest and very black on the crown, wings and tail. Entire under parts much lighter and more grayish plumbeous, insensibly blending with the color of the upper parts on the sides of the head, neck, and body, fading very gradually into whitish on the abdomen and under tail coverts. Inner webs of primaries, secondaries and tail feathers dusky gray; the outer glossy black; under surface of wings dusky gray, nearly black along the edge. Bill dusky, tinged with red; tarsi behind and toes below black; rest of feet an undefinable color in the dried state; perhaps reddish in life. "Eyes white and black," (collector's label).

This is a very strongly-marked species, differing to a remarkable degree from any other of the family. The chief peculiarity of form lies in the bill; so small, simple, extremely compressed, destitute of appendages, and otherwise unique, as will be seen by the description, and still more clearly by the diagram. As regards color, the tinge of clear plumbeous which pervades the uniform dark color is very characteristic. There is no trace of a crest, nor 1868.]

Bill very small and short, only half as long as the tarsus; extremely compressed, being hardly more than half as wide as high at the base; its height at base three-fourths the length of culmen; lateral aspect of the bill nearly triangular; culmen regularly lightly convex in outline; rictus perfectly straight; gonys almost straight, ascending; tip of bill rather obtuse; no tubercles, sinuosities, or other irregularities of surface or of contour. Nasal fossæ well marked, oval in outline, reaching the culmen at its base,

of elongated filiform feathers about the head. Their absence, however, is not to be regarded as a specific character, since it cannot be positively affirmed that the specimen is fully adult.

The affinities of the species are clearly with *S. tetraculus*, which it resembles in the small simple compressed bill. But it is unnecessary to compare the two and point out the differences. A glance at the dimensions will alone suffice to show specific distinction. There is no other bird in the family that *S. Cassini* in the least resembles.

SIMORHYNCHUS MICROCEROS, (Brandt,) *Coues*.

? *Alca pygmaea*, Gmelin, S. N. i, pt. ii, 1788, p. 555, No. 12; and of the older authors. Based on the Pigmy Auk of Pennant. Not identifiable.

Simorhynchus pygmaeus, Schlegel, *Urinatores* Mus. Pays-Bas, 1867, livr. ix, p. 23. Identifies *A. pygmaea* Gm. as *Phaleris microceros* Brandt or *P. nodirostris* Bonap., and *Uria pusilla* Pall. as young of the same.

Phaleris microceros, Brandt, Bull. Acad. St. Petersb. ii, 1837, p. 346.

Phaleris (*Ciceronia*) *microceros*, Cassin, B. N. A. 1858, p. 908.

Ciceronia microceros, Reichenbach.

Phaleris nodirostra, Bonaparte, Comp. and Geog. List, 1838, p. 66. Equals *microceros* Brandt. Audubon, Orn. Biog. v, 1839, p. 101, pl. 402. Audubon, B. Amer. vii, 1844, pl. 468. Gray, *Genera Birds*, lii, 1849, p. 644.

Ciceronia nodirostris, Bonaparte, *Consp. Gav. Comptes Rend.*, 1856, xlii, p. 774. "†*Phaleris corniculata*, Eschscholtz," (Gray.) Doubtful citation. Perhaps *Fratercula corniculata*? or *Cerorhina monocerata*?

Asiatic and American coasts of North Pacific; Kamtschatka; Kurile Islands; Plover Bay; Sitka; Japan. Numerous specimens in the Mus. Acad., Philadelphia, and Mus. Smiths. Inst., from various localities. Not known to occur as far south as Washington Territory, U. S., though found in the Japan Sea.

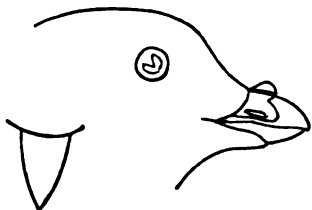


Fig. 11.—*Simorhynchus microceros*, (Brandt).
Nat. size.

Smallest of the Auks with the exception of *S. pusillus*. Bill very short, not half as long as the head, stout, deep, wide, little compressed, obtuse at the tip; its width at base nearly equalling its height at the same point, and but little less than the length of culmen. A small but conspicuous globular tubercle arising from base of culmen, beyond which the culmen is strongly arched, very regularly convex, rapidly descending, its tip not very acute, obsoletely notched on the tomlia, very slightly overhanging the tip of under mandible. Commissure almost straight its whole length, the extremity very slightly ascending. Gonys short, rapidly ascending, very slightly convex. Nostrils in a short but wide and deep fossa, placed rather higher up above the commissure than in some species; narrowly linear, not reached by the frontal feathers. Frontal feathers extending to the node on the culmen, then retreating obliquely backwards as they descend along the sides of the upper mandible; feathers on side of lower mandible extending farther than on upper mandible. Proportions of wings, tail, legs and feet as in other species of the genus.

Adult.—Forehead and lores conspicuously marked with delicate hair lines of white, produced by numerous short, stiff, but very slender white setaceous feathers scattered thickly thereover; a few of which filaments, more elongated and thread-like than the frontal ones, stretch adown the sides of the head

[Jan.

to below the level of the jaw; and a few more excessively delicate ones reach from the posterior canthus of the eye some distance along the sides of the occiput and nape. Entire upper parts, including the forehead, vertex, occiput, and sides of head, (with the exception of the white feathers just described) sides of neck, and wings and tail, glossy black. Inner webs of the primaries dusky gray. Under wing coverts, (except the smallest row just along the antibrachium and metacarpus,) white. Region about base of under mandible blackish plumbeous, and a few feathers along the sides under the wings and on the flanks blackish; all other under parts white, mottled, especially on the breast and sides, with black, the throat alone remaining immaculate. Bill red, tubercle and base of upper mandible dark bluish. Legs and feet an undefinable dusky in the dried state; the anterior border of the tarsus, and superior aspect of the toes dull greenish.

Length about 6.50; wing from carpus 3.75; tail 1.25; tarsus .70; middle toe and claw 1.00; outer do. the same; inner do. .85; bill: chord of culmen, (including width of knob) .40; along rictus .60; gonys .25; height at base .30; width at base slightly less.

The preceding is a description of the perfect plumage of this species, which is of comparatively unfrequent occurrence. The usual state of plumage of the bird as met with in collections is much as follows:—Bill as described above; filamentous feathers much as above described, but rather shorter and more sparse, and scarcely appearing behind the eye and along edge of side of lower jaw. Upper parts plumbeous black, sometimes slightly interrupted in its continuity by a few whitish feathers about the scapulars; the primaries grayish black, paler on their inner webs; secondaries grayish white at their tips. Under parts white, as before, but very sparsely marbled or waved with dusky; least so on the abdomen, most so on the sides and breast, where the blackish so increases in amount as to appear more or less continuous with that of the upper parts. Chin and sides of jaw as above described, but throat white, immaculate. The dusky mottling varies greatly in amount and in intensity with different specimens. Sometimes it is reduced to a few isolated touches here and there, and again it is found to give the prevailing color to the under parts. That specimens in this mottled condition are not immature, is proven by the fact that the bill is fully grown and provided with a well developed tubercle; and that the forehead is thickly covered with white setaceous feathers. The mottling, however, is confined to the tips of the individual feathers, whose bases are pure white; and is thus *apparently* of a temporary and transient character, like that so frequently met with in young or winter specimens of gulls and petrels. It may be a seasonal feature, or one only found in birds of a certain age; and yet numerous facts tend to indicate it as a character of perfectly mature birds. Were one to examine a specimen with the usual moderate amount of mottling on the under parts, and notice the fact that the blackish occupies only the tips of the feathers, he could not fail to be impressed with the analogy just now hinted at, and to conclude that with advancing age the mottling would grow less and less, and finally disappear, leaving the under parts pure white, as in *pusillus*. Such, however, appears not to be the case. Specimens whose age is attested by a fully developed bill and well formed tubercle, are those most mottled below with blackish. And yet, no specimens have been found with the breast or any other part of the under parts uninterruptedly black, trenchantly divided from white areas. The peculiar kind of mottling exhibited by this species is so unusual as a condition of perfect maturity, that the suspicion arises that the very highest state of plumage is not yet known.

Young.—Entirely similar in plumage to the bird as just described; but the under parts white, scarcely relieved by mottling; and the white extending far around on the sides of the neck, leaving only a narrow median dorsal line black; the bill smaller than that of the adult, and the tubercle wholly want-
1868.]

ing, or very imperfectly developed; its place on the culmen being occupied by a soft skinny covering like that on the nasal fosse.

Specimens frequently occur in this condition. An understanding of its precise import is somewhat complicated by the fact that, although the tubercle is entirely wanting, and the bill otherwise obviously undeveloped, the head is well provided with the whitish setaceous feathers. Birds in such condition might be confounded, on casual inspection, with *S. pusillus*. But more careful examination will result in the observation, that the bill is far too large, *thick*, and heavy to be that of *pusillus*; that there is no conspicuous white patch on the scapulars; that the size of the whole bird exceeds that of *pusillus*: which points, in connection with some others which might be enumerated, will serve to distinguish the two species. Their relationships are dwelt upon more at length in the succeeding article.

When old birds of this species are moulting, in the fall, the glossy black of the fresh feathers on the back is interrupted with dull grayish black patches, formed by the old feathers which have not yet been renewed; and the old worn primaries and secondaries are dull grayish, fading almost into grayish white at their tips and along their edges. A specimen in such a condition, (No. 46,563, Smiths. Mus.) though palpably an old bird, has no trace of a caruncle on the bill.

It may not, perhaps, be exceeding due bounds, to hint at the possibility that the nodule on the bill may be temporary in character, assumed after a certain age, at a certain season, and then lost, wholly or in part, by absorption, to be again resumed at the same period of the following year, probably during the season of reproduction. This suggestion presents itself to the observer without straining on his part, and, in fact, is rather forced upon his attention, after examination of specimens, apparently adult, in which no trace of the tubercle is to be found. The tubercle is in essential characteristics an extrinsic formation upon the bill, differing radically in its structure from the rest of the organ. No good reason appears to forbid the supposition that its growth and subsequent re-absorption, may be periodical. Arguments for such a belief might readily be adduced in the periodical hypertrophy and atrophy of the combs, wattles, caruncles, and the various other fleshy or cutaneous or semi-corneous growths about the head and bill of very many birds, which enlarge during the breeding season, and afterwards diminish or entirely disappear. It is also within the limits of possibility that caruncles of this species is a sexual characteristic. The specimen above mentioned, (No. 46,563,) is marked female. However close to, or remote from, the truth either or both of the foregoing suggestions may be, it is certain that observed facts relating to the rostral knob of this bird are at variance with generally received doctrines about it, and are explicable by the application of one or the other of the preceding hypotheses. At present we are very much in the dark in the matter.

Various ages, conditions of plumage and bill, of this species are well represented by the numerous specimens in the Museum of the Philadelphia Academy and of the Smithsonian Institution, from various localities along the coasts and among the islands of the North Pacific. No specimens are contained in any other American collection.

The only questions of synonymy which arise in this case are connected with the identification of *Alca pygmaea*, Gm., and are treated of under head of *S. pusillus*. Prof. Brandt's name has priority over that of the Prince Bonaparte, although the latter has come into more general employ than the former.

SIMORHYNCHUS PUSILLUS, (Pallas) *Coues*.

? *Alca pygmaea*, Gmelin. S. N. i, pt. ii, 1788, p. 555, No. 12; "rostro nigro, vertice, cervice, dorso, alis, caudâ pedibusque obscuris, jugulo et pectore glaucis, abdomine sordide albo. * * alce minor, 7 poll. longa," etc.—Based upon Pigmy Auk, Pennant, Arct. Zool. ii, p. 513, No. 431.

[Jan.

- Habitat between Northern Asia and America. Latham, Ind. Orn. ii, 1790, p. 790, No. ii. Same as Gmelin's species. Bonnaterre, Eacy. Method. Orn. 1790, p. 33. Same as Gmelin's species. Donndorff, Beytr. Zool. ii, pt. i, p. 825. Quotes Pennant and Latham.
- ? *Phaleris pygmæa*, Stephens, Shaws Gen. Zool. xiii, 1825, p. 48. Same as *Alca pygmæa*, Gm. Lath.
- Phaleris pygmæa*, Brandt, Bull. Acad. St. Petersb. ii, 1837, p. 347. Quotes both *Alca pygmæa* Gm. and *Uria pusilla* Pall., which he considers as synonymous. Gray, Genera Birds iii, 1849, p. 638. Quotes *Uria pusilla*, Pall.
- Tylorhamphus pygmæas*, Bonaparte Consp. Gav. Comptes Rendus, 1856, xlii. p. 774. Same as *pusilla*, Pall.
- Uria pusilla*, Pallas, Zoog. R.-A. ii, 1811, p. 373, pl. 70, haud dubiè. "Fronte brachiisque albo-notatis."
- Phaleris pusilla*, Cassin, Pr. A. N. S. Phila. 1862, p. 324. Elliot, B. N. Am. 1867, part vi.
- Phaleris* (*Ciceronia*) *pusilla*, Cassin, Baird's B. N. A. 1868, p. 909.
- Asiatic and American coasts of the North Pacific. Kamtschatka, (Pallas.) Semiaivine Straits (Mus. Smiths. Inst.) N. W. coast of America (Mus. Smiths. Inst.) Sitka, Russian Amer. (Mus. Pays-Bas, teste Schlegel.)

In size the least of its genus, and the smallest known natorial bird. Length, (approximately correct) 5.50 inches; extent of wings —, wing from carpus to end of first primary 3.50; tail 1.10; tarsus .75, middle toe and claw 1.10; outer toe and claw 1.00; inner toe and claw .85; bill along culmen .40; along rictus, .65; along gonys .30; height at base .20; width at same point the same or slightly less. (Compare these measurements, particularly of the bill, with those of *S. microceros*.)

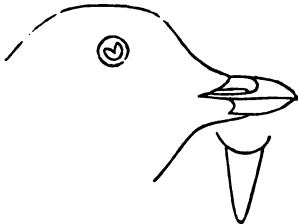


Fig. 12.—*Sinorhynchus pusillus*, (Pallas.)
Nat. size.

With the usual form of the genus, except as to the bill, the shape of which is specific. Bill without tubercles, or other irregularities of contour; straight, comparatively slender, compressed; height at base much less than length along culmen; width at base the same, or rather less than, height at same point; the apex more acute than that of *microceros*; the outline of culmen at first straight, then slightly convexo-declinate; commissure almost straight, a little ascending anteriorly, still not sinuous in any part of its length; gonys lengthened, at first convex in outline, then rapidly ascending in a straight line. Nasal fossa large, extending along the basal moiety of the bill, reaching from the culmen nearly to the tomia; not deeply excavated; nostrils small, narrow, linear, one eighth of an inch long, basal, lying just above the commissural edge of the upper mandible. Frontal feathers running forward some distance in a rather narrow angle on the culmen, retreating very rapidly obliquely backwards and downwards on the sides of the upper mandible; extending on sides of the lower mandible a little further than on upper. (It is to be gathered from this description, more particularly, that the bill of *pusillus*, compared with that of *microceros*, is fully as long; but slenderer, more acute at the tip, less convex along culmen and gonys, more compressed in its whole extent, and non-tuberculate.)

Adult.—Entire under parts pure white; entire upper parts pure black, only relieved as follows: The humeral and scapular feathers are, all of them 1868.]

or most of them, white or whitish in some portion or the whole of their extent; producing two patches of this color, not inaptly comparable to the similar patches on the scapulars of *Brachyrhamphus Wrangeli*, or *Collyria borealis*, in size, shape and general appearance. About half the secondaries, the innermost ones, are quite conspicuously white on the tips of the outer web for a fourth or a third of an inch. The forehead and lores, from the base of the bill to the eyes and vertex, are lineated (exactly as in *microceros*) with sparse, distinct, very slender white setaceous feathers; none are apparent, among several specimens, behind the eye, or from the commissural angle of the bill. Pallas tersely summed up these points of coloration of the upper parts in saying "Fronte brachiiisque albo-notatis;" and the white about the "arms" is a strong distinctive feature of the species in comparison with *microceros*. The white of the under parts reaches far around on the side of the neck; on the side of the head it only extends on a level with the commissure; it does not quite attain the base of the lower mandible, being cut off from the bill by a small blackish-lead-colored area. There are indication of a small whitish spot just above and below the eye, formed of feathers of the ordinary texture. The under wing coverts are wholly white, except just along the edge of the forearm. The short tibial feathers are dusky gray. Bill black, (as nearly as can be determined from the dried specimens,) the base, gony and tip of lower mandible yellowish. Posterior aspect of tarsus, and inferior surface of toes and webs, blackish; rest of legs and feet a dull undefinable greenish-dusky (in the dried specimens.)

The changes of plumage of this species are not known; no other condition than the one above described is represented by the specimens in the Smithsonian Institution, and none are contained, as far as known, in any other American museum. No. 21,320 of the Smithsonian collection, obtained from Capt. John Rodgers' expedition to the North Pacific, collected at Semiafine Straits by Dr. Wm. Stimpson, is the one above described. No. 21,321, from the same locality, is a younger bird, but entirely similar to 21,320, except that it has a rather weaker bill, and only slight traces of the white setaceous feathers on the forehead. No. 46,562, collected Sept. 9th, 1866, at Plover Bay, by W. H. Dall, of the Western Union Company's Overland International Telegraph Expedition, a young bird, as shown by the soft feel of the feathers and other features needless to detail, is referrible, with some degree of doubt, to this species. The scapulars are very conspicuously white; the secondaries plainly tipped with white; the under parts pure white, unspotted as in typical *pusillus*. The black of the upper parts is tinted, especially about the head, with gray or plumbeous, and there are no traces of whitish setaceous feathers on the forehead; both of which features are to be attributed to the juvenility of the specimen. The doubt in the case centres in the bill. This organ has no trace of a tubercle, and is very small and weak, as usual in the young *pusillus*; but it seems to be deeper, and especially wider at the base, compared with its length, than is the case with typical *pusillus*; in these points of shape approximating to *microceros*. But "seems to be" is the most definite expression to be used in this case, for in the preparation of the specimen, or its subsequent drying or packing for transportation, the bill has been injured, and so much distorted, that its true form cannot now be determined with desirable precision.

It cannot be denied that the relations that this species bears to *microceros* are extremely intimate. So closely, in fact, does it approach the latter, that its specific validity might fairly be called in question by one of conservative views; especially in consideration of the well-known fact, not to be disputed, that the bills of all young *Alcidae* are much smaller and weaker, and even in more striking points of form, conspicuously different from those of adult birds; and that a long time is required for their perfect development. This remark applies with especial force to the formation of the various knobs, ridges, sulci, rictal callosities, and the other irregularities of surface. The

[Jan.

mere presence or absence, therefore, of the node upon the base of the culmen, cannot be allowed to constitute a specific character in the present case, and may be left out of consideration, as may be, also, the color of the bill. Too much stress should not be laid upon the presence of white scapulars and of white tips to the secondaries, since in some specimens of undoubted *microceros* unmistakable traces of the former are to be found, and the ends of the inner secondaries are decidedly lighter than the body of the feathers. All the observable differences in the quantity and distribution of the whitish setaceous feathers upon the forehead and other parts of the head might readily enough depend upon a difference in the age of specimens. The pure uninterrupted white of the under parts of *pusillus* stands in apparently strong contradistinction to the black mottling of the same parts of *microceros*; but it is to be remembered that the coloration in this respect of the latter species is very variable, ranging from a very sparse and scanty marbling to a nearly uniform black, particularly upon the breast, and is therefore not to be too implicitly relied upon, at least until it is more definitely ascertained than at present whether the black mottling tends to decrease or to increase with advancing age. If *microceros* grows more and more marbled with black as it grows older, we might with entire propriety presume upon the existence of a youthful state of plumage, in which the under parts are entirely white, like those of *pusillus*. Such is very likely the real state of the case; for the youngest examples of *microceros* examined—those which have no trace of a tubercle—are nearly white below, only very sparsely and indistinctly mottled with blackish. Still, aside from all these varying and therefore uncertain points, there appear good grounds for separating the two species, as will be observed on comparing the descriptions given in this and in the preceding article.

As the case stands with our present information upon the subject, *P. pusillus* is to be separated from *P. microceros*: first, by certain differences positively known to occur: *a*, in size, which is decidedly less, as evidenced by the measurement of all its dimensions; *b*, in form of bill, which is slenderer, more acute at the tip, not so deep at the base, particularly not so wide at the base, yet not shorter, than that of *microceros*; secondly, by certain differences very constantly observed, yet not proven to always hold good: *a*, absence of tubercle; *b*, conspicuously white scapulars and tips of secondaries; *c*, pure white under parts, uninterrupted by blackish mottling, and extending around on the sides of the neck; *d*, shortness and scantiness of the white setaceous feathers on the forehead; *e*, color of bill, mostly black, not mostly red.

It only remains to notice the synonymy of this species, and all that is to be said on this score relates to the identification of *Alca pygmæa* Gm. This name is founded upon the "Pigmy Auk" of Pennant,—a small species first described very loosely and imperfectly by the latter writer, whose account Gmelin merely renders into Latin, in applying a binomial name. There is no doubt that the bird was one of the little Auks of the North Pacific, as its very name, and the dimensions assigned (seven inches), clearly indicate, but there is no possibility, at the present day, of identifying it with precision. It was very possibly based either upon the present species or the preceding (*microceros*), and should these two ever be united, as young and old of the same, the name *pygmæa* might without undue violence be assigned to the species so constituted. So long as they are regarded as distinct, the name *pygmæus* must not be applied to either of them. As far as we can judge by the description, particularly the expression "jugulo et pectore glaucis," *pygmæa* may not impossibly have been based upon *Ptychoramphus aleuticus*. But Mr. Cassin's supposition is perhaps as near the truth as any that could be advanced: "It is possible that the Pigmy Auk of Pennant, which is *Alca pygmæa* Gmelin, may be the young of this species [*microceros*], but it is more probable, judging from the descriptions of Gmelin and Latham, that several small species have been confounded under this name." The same gentleman 1868.]

also calls attention to the fact, that some of the expressions in the diagnoses of the old authors have no basis in the characters of any Alcidine bird. Under the circumstances, it behooves us to ignore the name *pygmæa* altogether, since it cannot be identified; and to accept *pusillus* of Pallas, to which no possibility of doubt attaches, as the proper name of the present species.

PTYCHORHAMPHUS, Brandt.

Uria, Pallas, Zoog. R.-A. 1811, ii, p. 370, in part; not of authors.

Ptychorhamphus, Brandt, Bull. Acad. Sc. St. Petersb. ii, 1837, p. 347. Type *Uria aleutica*, Pall.

Mergulus, Gambel, Pr. A. N. S. ii, 1842, p. 266, in part; not of Ray, Vieill.

Arctica, Gray, Genera, iii, 1849, p. 638; in part; not of Möhring.

Simorhynchus, Schlegel, Mus. Pays-Bas, 1867, livr. ix, p. 26, in part; not of Merrem.

Size moderate; general form stout; not crested, nor with any elongated feathers about the head. Bill about two-thirds as long as the head, three-fourths as long as the tarsus, very stout, straight, somewhat conical in shape, slightly if at all compressed, without nodes or irregularities, the tip acute; culmen very moderately declinato-convex in outline, the ridge broad, more or less corrugated transversely at the base; the sides of upper mandible bulging, the tomial edges inflexed; sides of lower mandible nearly upright, flat, longitudinally grooved for the greater part of their length, their tomial edges somewhat inflexed; rictus straight; gonys straight, or nearly so, very long. Nasal fossæ long and wide, shallow, filled in with soft skin; that of the two fossæ meeting over the base of the culmen, and there corrugated as just described; nostrils rather long, narrowly oval, subbasal, opening at the lower border of the fossæ, the edge of the membrane that overhangs them elevated, flaring. Frontal feathers in a nearly transverse line across the base of the culmen, thence descending a little obliquely backwards, just behind the nostrils, to the commissure; those on lower mandible extending, in the interramal space (which they completely fill), to a point rather beyond a perpendicular from those on culmen; then, encroaching very little on the sides of the lower mandible, they retreat in a straight line rapidly backwards and obliquely upwards. Wings moderately long, narrow, pointed, the primaries somewhat falcate, narrowing rapidly at the tip to an acute point, first longest, rest equably graduated. Tail short, broad, rounded, contained about three and a half times in the length of wing from the carpal joint; the feathers broadly rounded at their tips. Tarsus much shorter than the middle toe without its claw; about two-thirds as long as the middle toe and claw; greatly compressed, covered with small, very irregularly shaped polygonal reticulations; no large transverse scutellæ. Outer lateral toe as long as, or slightly shorter than the middle; its claw not reaching the tip of the middle claw. Tip of inner claw reaching base of middle one. Claws compressed, acute, moderately arched, the inner edge of the middle one dilated.

This genus was instituted in 1837 by Prof. Brandt, for the reception of the *Uria aleutica* of Pallas, its type and only species. It is strongly characterized by the bill, which is of a shape not even approximating towards that of any other Alcidine bird. Its points of structure in other respects are shared by the majority of the family.

PTYCHORHAMPHUS ALEUTICUS, (Pall) Brandt.

Uria aleutica, Pallas, Zoog. R.-A. ii, 1811, p. 370. "Corpore suprà fusco, subtus albo liturato, rostro producto, triplici plica inter nares."

Ptychorhamphus aleuticus, Brandt, Bull. Acad. St. Petersb. ii, 1837, p. 347. Bonaparte, Tabl. Comp. Pelag. Compt. Rend., 1856, xlii, p. 774. Cassin, Baird's B. N. A. 1858, p. 910. Heermann, Pac. R. R. Rep. x, 1859, Route to Cala. Birds, p. 75. Elliot, B. N. Am. part iv, 1867.

Phaleria aleutica, Gray, Genera Birds, iii, 1849, p. 638.

[Jan.

Simorhynchus aleuticus, Schlegel, *Urinatores Mus. Pays-Bas*, ix livr. 1867, p. 26.

Mergulus Cassinii, Gambel, *Pr. A. N. S. Philada.* ii, 1845, p. 266. *Id.*, *Journ. A. N. S. Phila.* 2d series, ii, 1850, pl. vi.

Arctica Cassinii, Gray, *Gen. Birds*, iii, 1849, p. 638.

Pacific coast of North America, south to San Diego, California. Breeds on the Farrallone Islands. Aleutian Islands (Pallas), Russian America, and whole west coast of the United States. (*Mus. Smiths. Inst. and Acad. Philada.*)

Adult.—Bill black, base of lower mandible whitish or yellowish. Legs anteriorly, and toes superiorly bluish; legs posteriorly, and toes inferiorly, with the membranes, blackish. A slight touch of white about the eyes. Entire upper parts blackish-plumbeous, the head, wings and tail nearly black. This color, gradually diluted until it is much more grayish-plumbeous, extends around the under parts and sides of the head, the throat, upper part of the breast, and whole sides of the body under the wings. Greater part of breast, with abdomen and under tail coverts pure white; the grayish plumbeous of the upper breast merging very gradually into the white of the belly. Under surface of wings dark lustrous gray.

Young.—Very similar to the adult; differing chiefly in being more decidedly blackish on the upper parts.

Moulting specimens have the upper parts much duller and grayer, the old wing and tail feathers faded, especially towards their tips, into light brownish-gray.

Length 8.00 to 9.50; extent 16.00 to 18.50; wing 4.75 to 5.25; tail 1.50 to 1.75; tarsus about 1.00; middle toe and claw 1.40; outer do. 1.30; inner do. 1.10; culmen .75; rictus .90; gonys .60; depth of bill opposite posterior extremity of nostrils .40; width .30.

As regards color, this species is remarkably constant. Hardly any other differences than those first noticed are to be found, after examination of extensive series; and they may all be summed up as merely varying shades of the same color, and slight variation in its extent downwards upon the breast. The bill at all ages and seasons presents its peculiar parti-coloration. These remarks, however, probably do not apply to fledgelings. As regards size, the species is perhaps unusually variable, as may be seen by the measurements given above, which represent extremes in those cases where two sets of figures are given, and the average in other measurements. The bill, in particular, is liable to great variation both in length and in stoutness. Some bills are very large and robust, nearly as wide as high at the base, rather obtuse at the tip, and with decidedly curved culmen and gonys; others are longer in proportion to their transverse dimensions, decidedly compressed throughout, acutely pointed, with almost straight culmen and gonys. The corrugations about the base of the upper mandible are sometimes nearly obsolete, and when present are very variable in character. Very likely they are hardly, if at all, apparent in life; for they seem to be produced mainly by the shrinking in drying of the skin covering the nasal fossæ and base of the culmen. All the variations exhibited by the numerous specimens seem to be merely individual differences, and are not sufficient to excite a suspicion that more than one species is represented in the series.

Mergulus Cassinii Gambel (*Arctica Cassinii* Gray) is now well known to be this species, first described by Pallas, as above quoted. The species has no other synonyms of consequence. Its striking peculiarities suffice to prevent misconception regarding it.

Subfamily URINÆ.

MERGULUS, (Ray) Vieill.

Mergulus, Ray, *Syn. Av.* Vieillot, *Analyse*, 1816, and of authors. Type *Alca alle*, Linn.

1868.]

Plautus, Klein, Prod. Av. p. 140. In part.

Arctica, Mehring, Av. Gen. 1752, p. 65. Type *Plautus columbarius*, Klein, Gray, Genera, iii, 1849, p. 644. Type *Alca alle*, Linn.

Alca, Linnæus, S. N., i, 1758. In part.

Uria, Pallas, Zoog. R. A. 1811, ii. In part.

Bill very short, culmen only three-fourths the tarsus, very stout, scarcely compressed, obtuse at the tip, as wide as high at the base, the sides of both mandibles convex or vaulted, the tomial edge of the upper greatly inflected, the culmen very convex in outline, with a broad flattened ridge, the rictus ample, much decurved towards the end, the gonys straight, very short, the inferior mandibular rami correspondingly elongated, widely divaricating, the interramal space very broad, the nasal fossæ short, wide, deep, partially feathered. Nostrils subbasal; short, more broadly oval, or more nearly circular than in any other genus except *Synthliborhynchus*. Wings rather longer than usual in this family, acutely pointed. Tail of ordinary length, much rounded, the feathers rather narrow and subacuminate at tip. Feet small and weak; tarsus scarcely compressed, anteriorly broadly scutellate, posteriorly finely reticulate. Toes of the usual proportionate lengths. Size very small; general form very compact, stout.

A peculiar genus of the *Alcidae*, the most essential characters of which, as usual in this family, are found in the bill, though the other members offer some appreciable, if not salient features. The squat bunched shape of the single species is very noticeable.

This is the genus through which a certain type of structure found among the Longipennes inosculates with the Pygopodes. The relationship of *Pelecanoides urinatrix* to *Mergulus alle* is one of strong analogy, if not of actual affinity, as has been elsewhere already pointed out by the writer.* Aside from the obviously Procellariidian characters of the bill, *Pelecanoides* (representing the subfamily *Halodrominæ*) is strictly a Pygopodous genus, and is very nearly identical with *Mergulus* in all the details of external structure, and has much the same general habitus. It is certainly the connecting link between the macropterous and brachypterous natatores, holding so strangely anomalous a position betwixt the two, that it cannot be with much propriety included under either. It seems entitled to the rank of a family, to take place between the *Procellariidæ* and *Alcidæ*.

MERGULUS ALLE, (Ray) Vieill.

Mergulus melanoleucus, Ray, Syn. Av. p. 125. Stephens, Shaw's Gen. Zool. xiii, 1825, p. 345. Brandt, Bull. Acad. St.-Petersb. ii, 1837, p. 347. Brewer, oct. ed. Wilson's Orn., with notes by Jardine, 1840, p. 658, fig. 315. Fleming, Hist. Brit. Anim. 1842, p. 135. Thompson, Nat. Hist. Ireland, iii, 1851, p. 218.

Columba grælandica, "Albanus, Av. p. 81, pl. 85. Gunn., Act. Nidroff, i, p. 206, pl. 6."

Plautus columbarius, Klein, Prod. Av. p. 146, No. 1.

Alca alle, Linnæus, S. N. ed. x, i, 1758, p. 131, No. 6. Id. ibid. ed. xii, 1766, i, p. 211, No. 5. Brünnich, Orn. Bor. 1764, p. 26, No. 106. Hermann, Tab. Affn. Anim. p. 149. Müller, Zool. dan. Prodr. p. 17, No. 142. Latham, Ind. Orn. ii, 1790, p. 795, No. 10. Donndorff, Beytr. Zool. ii, pt. i, 1794, p. 823, No. 5.—Donndorff's Var. B is *candida* Lath.—Wilson, Am. Orn. ix, pl. 74, fig. 5. Schlegel, Urinatores Mus. Pays-Bas, ix livr. 1867, p. 20.

Uria alle, Pallas, Zoog. R.-A. ii, 1811, p. 369. Temminck, Man. Orn. ii, 1820, p. 928. Bonaparte, Obs. Wils. 1826, No. 238. Audubon, Orn. Biog. v, 1838, p. 304, pl. 339.

Uria (Mergulus) alle, Bonaparte, Synopsis, 1828, p. 425.

* Cf. Pr. A. N. S. Philada. May, 1866, pp. 172, 189.

Mergulus alle, Vieillot, Analyse, 1816, p. 66. Id., Gal. Ois. 1825, p. 236, pl. 295. Gould, Birds Eur. v, 1837, pl. 402. Macgillivray, Hist. Brit. Birds, ii, 1852, p. 341. Bonaparte, Comptes Rendus, 1856, xlii, p. 774. Cassin, Baird's B. N. A. 1858, p. 918. Boardman, Pr. Bost. Soc. N. H. Sept. 1862, p. 131. Verrill, Proc. Essex Inst. iii, 1863, p. 160. Samuels, Ornith. and Ool. of New England, 1867, p. 570.

Arctica alle, Gray, Gen. Birds, iii, 1849, p. 644.

Alca alce, Gmelin, S. N. i, pt. ii, 1788, p. 544, No. 5.

Alca candida, Brännich, Orn. Bor. 1764, p. 26, No. 107. In pure white plumage; probably albino.

Mergulus arcticus, Brehm.

European and American coasts of the North Atlantic. On the United States coast, in winter, south to New Jersey. Numerous specimens in Mus. Acad. Philada., Smiths. Inst., Bost. Soc. Nat. Hist., Essex Inst., Cab. G. N. Lawrence, author's Cab., etc.

Adult, summer plumage.—Head and neck all around, and entire upper parts glossy black, with a beautiful metallic lustre of a shade of blue, when in highest plumage; scapulars edged with white; shafts and inner webs of primaries brown, lighter at base; secondaries tipped with white; under surfaces of the wings brownish-gray; under parts from the breast pure white, with a few elongated feathers of the sides and flanks varied with black on the outer webs; bill black; legs and feet posteriorly blackish, anteriorly flesh-colored (dull yellowish in the dried state).

Adult in winter.—As before; the white of the under parts extending on the neck and throat to the bill, on the sides of the head to the level of the rictus, on the sides of the nape over the auriculars (where it is somewhat marbled with black), or even to the middle of the nape, more or less confluent with that of the other side.

Young, first winter.—Recognizable by its smaller and weaker bill, by the duller and more brownish black of the upper parts, almost wanting in gloss, and by the greater extension of the white upon the sides of the hind head and neck. The scapulars and coverts are conspicuously marked with white, as in the adult. The feet are mostly dusky.

Length 8.50; wing 4.75; tail 1.50; tarsus .80; middle toe and claw 1.20, outer do. 1.15, inner do. .85; bill along culmen .50, rictus 1.00, gonys .20; its depth at base .35, its width at same point about the same.

When in mature plumage, this is a very beautiful species. No other Alcidine has such lustre of the dorsal plumage, traces of which are even found in adult winter specimens. In the latter the extent of the black upon the throat is indicated by a dusky clouding of the bases of the feathers of the parts. The species is ordinarily subject to only moderate variation in size or colors. The condition of albinism has been described.

The first chronicles of this species are of great antiquity. It appears to have shared for a time with *Uria grylle* the soubriquet of "*Columba grœnlandica*." Since its description as *Alca alle* by Linnæus, it has been the basis of very few synonyms. *Alca candida* of Brännich is this species in the albino state. *Mergulus melanoleucus*, Ray, is adopted by many authors. Mr. G. R. Gray adopts Mœhring's generic appellation.

SYNTHLIBORHAMPHUS, Brandt.

Alca, Gmelin, S. N. i, 1788, p. 554, and of the older authors, in part.

Uria, Pallas, Zoog. R.-A. ii, 1811, and of some authors, in part.

Fratercula, Stephens, Shaw's Gen. Zool. xiii, 1825, in part.

Synthliborhamphus, Brandt, Bull. Acad. St. Petersb. ii, 1837. (Type *Alca anti-gua*, Gm.) Subgenus of *Brachyrhamphus*, Brandt.

Mergulus, Vigors, Zool. Voy. Blossom, 1839, in part.

1868.]

Arctica, Gray, Genera, iii, 1849, in part.

Anobapton, Bonaparte, Comptes Rendus, 1856, xlii. p. 774, in part.

Size moderate or rather small; general form stout, compact; head with or without a crest; bill somewhat as in *Brachyrhamphus*, but much stouter, and shorter for its depth; much compressed throughout, depth at base about half the length of culmen, culmen and gonyes moderately curved, gonyes straight, ascending; nasal fossæ small and shallow; nostrils subbasal, broadly oval or nearly circular, as in *Mergulus*, feathered; feathers extending to about the same distance on culmen and keel; on both mandibles retreating rapidly backwards from the point of their furthest extension; those on the upper passing just by the nostrils, but not covering the latter. Wings of usual size and shape in this group; secondaries very short, as in *Brachyrhamphus*, the tip of the longest not reaching much more than half-way from the carpal joint to the end of the first primary in the closed wing. Tail of usual length, short, broad, nearly square, or very slightly rounded, the feathers very broadly rounded at tip. Tarsi much compressed, anteriorly and laterally transversely scutellate, posteriorly reticulate; about as long as the middle toe without its claw. Outer toe as long as or rather longer than the middle; its claw smaller than that of the middle; tip of inner claw reaching base of middle. Claws small, short, compressed, moderately curved and acute, the inner edge of the middle one somewhat dilated.

With the general appearance of *Brachyrhamphus*, this genus differs from the latter in the bill and feet. The bill is deeper at the base, and more compressed throughout; the feet are still more different, having very broad transverse scutellation on the anterior face of the tarsus, instead of polygonal reticulation; and are larger, both relatively and absolutely, with longer, much more compressed tarsi than in *Brachyrhamphus*. The type of the genus is the old *Ales antiqua* Gm. A second species occurs, which differs from the type, as far as form is concerned, in a slenderer bill, and in the presence of a conspicuous crest.

Species.—(3.)

Not crested; bill stout, depth at base more than half the length of culmen; white on sides of vertex not extending in advance of the eyes..... *antiquus*.

Crested; bill slender, depth at base about equal to half the length of culmen; white on sides of vertex extending along sides of forehead nearly to the bill..... *aurimurum*.

SYNTHLIBORHAMPHUS ANTIQUS, (Gmel.) Brandt.

Alca antiqua, Gmelin, S. N. i, pt. ii, 1788, p. 554, No. 11. Based upon Antient Auk, Pennant, Arct. Zool. 1785, ii, p. 512, No. 430. Latham, Ind. Orn. ii, 1790, p. 795, No. 9. Donndorff, Beytr. Zool. ii. pt. i, 1794, p. 824. Schlegel, Urinatores Mus. Pays-Bas, livr. ix, 1867, p. 21.

Fratercula antiqua, Stephens, Shaw's Gen. Zool. xiii, 1825, p. 42.

Uria antiqua, Temminck and Schlegel, Fn. Japon. 1845, pl. 80. Audubon, Orn. Biogr. v, 1839, p. 100, pl. 402, fig. 12. Id. B. Amer. vii, 1844.

Brachyrhamphus (Synthliborhamphus) antiquus, Brandt, Bull. Acad. St. Petersburg, ii, 1837, p. 347. Cassin, Baird's B. N. A. 1858, p. 916.

Brachyrhamphus antiquus, Gray, Gen. Birds, iii, 1849, p. 644.

Anobapton (Synthliborhamphus) antiquus, Bonaparte, Conspectus. Gav. Comptes Rendus, 1856, xlii, p. 774.

Uria senicula, Pallas, Zoog. R.-A. ii, 1811, p. 369, pl. 85.

Mergulus cirrhocephalus, Vigors, Zool. Voy. Blossom, 1839, Birds, p. 32.

Arctica cirrhocephala, Gray, Gen. Birds, iii, 1849, p. 644.

[Jan.

American and Asiatic Coasts of the North Pacific. Kamtschatka, Japan Seas. Sitka, Russian America, (Mus. Smiths. Inst.) Mus. Acad. Philada.

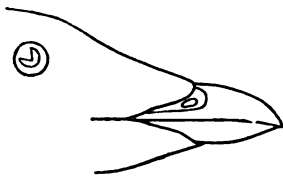


Fig. 13.—*Synthliborhamphus antiquus*, (Gmel.)
Nat. size.

With the form, etc., typical of the genus, as above described.

Adult, high breeding plumage, (No. 46558, Mus. Smiths. Sitka, R. A.) Bill whitish, or yellowish, culmen and base of both mandibles abruptly black; legs and feet anteriorly apparently whitish, or yellowish; posteriorly, with both surfaces of the webs, black. Head all

around, and throat, black; pure and intense above, on the sides below, chin and throat, tinged with fuliginous brown. A conspicuous stripe of pure white beginning over each eye, and extending backwards over the sides of the occiput, connected across the nape by some white feathers, and spreading on the sides and back of the neck, as a large disconnected series of treacherously defined white streaks. Trace of white on each eyelid. Entire upper parts clear dark plumbeous, blackening on the upper tail coverts and tail. Upper surface of wings the same, or rather darker, the edge of the wing all along from the elbow, and the exposed parts of primaries; blackish; entire under surface of wings white, except just along the edges where it is mottled with dusky; the basal portion of the inner webs and shafts of primaries whitish; secondaries like the wing coverts, or rather darker, their bases whitish. Sides of the body under the wings pure velvety black, in marked contrast to the clear plumbeous of the upper parts and white of the lower. These black feathers are posteriorly greatly elongated, reaching quite to the tail, and overlying the sides of the rump and the flanks, which latter, however, are seen to be pure white on raising the elongated supercumbent feathers. This black along the sides extends anteriorly in front of the wings, and, still strongly contrasted with the plumbeous of the interscapulars, continues on as a band quite to the nape, which it crosses to become confluent with its fellow of the opposite side. On the sides of the neck it is thickly marked with the pure white streaks already described. The fuliginous black of the chin and throat is continuous with that of the sides of the head as far as the auriculars; further on it merely extends as a point along the middle of the throat, being separated from the black of the sides of the nape by a large white area, an extension to the auriculars of the white which is the color of the whole under parts except the sides under the wings, as already described.

Length 9.50 to 10.50; extent 16.75 to 18.25; wing 5.50; tail 1.60; bill along culmen .60, along rictus 1.20, along gonys .40, depth at base .30, width .20; tarsus 1.00; middle toe and claw 1.25, outer do. 1.15, inner do. 1.00.

Younger.—Bill and feet as above described. "Iris brown," (label). Upper parts as in the adult, but darker, the plumbeous being obscured by dusky, especially on the wing and tail coverts, and lower back. Forehead, crown, nape, and back of neck, sooty black, entirely unrelieved by white streaks, or with only traces of the latter on the sides of the occiput. Eyelids sometimes largely white. No black on the throat or chin; traces of it in a dusky mottling about the base of the bill. White of under parts extending on sides of head below and behind nearly to the eyes, and far around on the sides of the nape, so that only a median nuchal line is left blackish. Sides of body under the wings not pure black, but merely dusky plumbeous, and this not continuous on the feathers over the flanks, these being in some part white, producing a white and plumbeous variegation. The line of this dusky plumbeous hardly extends in front of the wings to the sides of the neck. Under parts white, as before, the bases of the inner webs of the primaries rather more white than in the adult.

1868.]

The above described differences between the adult and young are very decided, and might suggest a distinction of species, were not various means between the extremes forthcoming. Beyond these variations in plumage the species is very constant in characters, with the exception of the bill. This differs a good deal as to its size and shape; but nevertheless usually preserves the specific characters which distinguish it from that of *Wurmizusume*. Thus the difference in length between the bills of two perfectly mature examples, absolutely identical in plumage, and in all other respects, save length of bill, amounts to a tenth of an inch along the culmen. This difference being unaccompanied by a corresponding difference in depth and width, gives a readily appreciable difference in shape of the bill.

The only species to which the present bears any special resemblance is *Wurmizusume*. The comparative characters of the latter are dwelt upon at length in the article immediately succeeding.

It is barely possible that two distinct species may be confounded in the synonymy adduced at the head of this article, and that the bird here described is not the veritable *Alca antiqua*, Gm., ("Antient auk" of Pennant.) In the description of these authors the upper parts are said to be dusky or sooty black, whereas, as will be seen by the description, the subject of the present article has these parts clear plumbeous. But we have just seen that the young of the present bird has the upper parts decidedly darker and duller than the adult; in fact tending, especially upon the wings and lower back, to dusky. The limits within which the species is known to vary in this respect are sufficiently wide to allow its reference to the bird of Pennant, Latham and Gmelin; especially when it is remembered that the particular descriptive terms used by these authors may not have been critically correct. It seems unnecessary, and it would be, perhaps, unjustifiable to attempt to discriminate the present species from *Alca antiqua*, upon the grounds just mentioned. They had best be regarded as the same, at least until suites of specimens may determine the existence of two species, differing in the particulars above mentioned. No indications of a distinction of species can be found in the extensive series of specimens at present contained in American collections.

This species, in the condition here described as that of the adult, is the *Uria senicula*, Pallas; and should bear the name of *Synthliborhamphus seniculus* in the event of its not proving the same as *Alca antiqua*, Gm. *Mergulus cirrhocephalus*, Vigors, (*Arctica cirrhocephala*, Gray,) is the same bird, in the same condition of maturity. The species has no other synonyms of consequence, except those resulting from its reference to several different genera.

In breeding plumage it is a very handsome bird, being in fact—with the exception of *Wurmizusume*—the handsomest of the *Urinæ*. It is of frequent occurrence along the coast and among the islands of the North Pacific; extending, on the Asiatic side, to Japan, and on the American, to Washington Territory, U. S. It apparently migrates southward in winter. It breeds in the vicinity of Sitka, R. A. It is well represented by numerous specimens in the collections of the Philadelphia Academy and of the Smithsonian Institution. It has been figured by Temminck and Schlegel, and by Audubon.

SYNTHLIBORHAMPHUS WURMIZUSUME, (Temm.) Coues.

Uria Wurmizusume, Temminck, Pl. Color, No. 579. Temminck and Schlegel, Fn. Japon, 1845, pl. 79.

Anobapton (Synthliborhamphus) Wurmizusume, Bonaparte, Tab. Comp. Pelag. Comptes Rendus, 1856, xlii, p. 774.

Brachyrhamphus (Synthliborhamphus) Temminckii, Brandt, Bull. Acad. St. Petersb. ii, 1837, p. 347. Cassin, Baird's B. N. A. 1858, p. 916.

Brachyrhamphus Temminckii, Gray, Gen. Birds, iii, 1849, p. 644. Cooper and Suckley, Pac. Rr. Rep. xii. p. ii, 1860, p. 287. Elliot, B. N. Am. part vi, 1867.

Alca Temminckii, Schlegel, Urinat. Mus. Pays-Bas, livr. ix, 1867, p. 22. (Japan.)

[Jan.

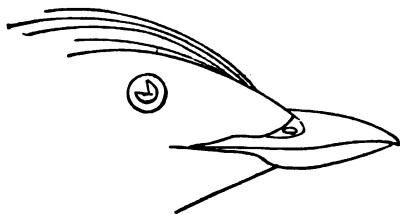


Fig. 14.—*Synthliborhamphus Wurmirusume*, (Temm.)
Nat. size.

Asiatic and American Coasts of the North Pacific; south to Japan and Washington Territory, U. S. Specs. in Mus. Acad. Philadelphia, and Mus. Smiths. Inst.

Bill more slender and elongated than in the type of the genus, the depth at base less, and the compression not so great, the sides of the bill being less vertical; rictus nearly straight. Rather larger than *S. antiquus*.

Adult.—Bill decidedly yellow, (in the dried state,) the ridge of upper mandible alone black. Feet dull livid bluish, the webs dusky, (feet dusky yellowish in the dried state) "Eye brilliant gray, iris black" (label). A large conspicuous crest springing from the extreme forehead of a dozen, (more or fewer) slender elongated features, not recurved, but extending straight backwards quite to the occiput. A large conspicuous series of white feathers on each side of the top of the head, extending from the base of the crest, on the forehead far in advance of the eyes, to the side of the nape; there more or less confluent with each other, and then dispersed as isolated white streaks over the sides of the neck to the shoulders. In many specimens, however, apparently quite adult, these white stripes are hardly, if at all, apparent beyond the nape. Rest of head, including chin and upper part of throat sooty or fuscous blackish, sometimes with a cinereous tint; this color extending as far as the interscapular region, from which point the upper parts are more decidedly plumbeous, only the wings and tail being somewhat darker and more fuscous. Sides under the wings plumbeous black quite to the flanks; this color also extending forward in front of the wings and continuous with that of the sides of the neck and head. Under surface of wings pure white, except a little dusky clouding along the edge; bases of primaries, and the greater portion of their inner webs white, deepening very gradually through a continuously deepening shade of brownish gray, into dusky at the tips. Entire under parts (except the sides, as just described) pure white.

Length 10.50 to 11.00; extent 18.00 to 18.50; wing 5.50; tail 1.75; tarsus 1.00; middle toe and claw 1.25, outer 1.20, middle 1.00; bill along culmen .70, rictus 1.10; gonys .40; height at base .25 to .30, width about the same.

Younger.—Bill and feet as above; (bill sometimes, however, wholly blackish.) Without a crest; no white feathers about head, or only slight traces thereof. Face, including region just about the base of the bill, both above and below, crown and sides of the head to the level of the commissure, with nape and back of neck, plumbeous dusky; other upper parts, particularly the wings, the same, but most of the back with a more decided tint of plumbeous. Under wing coverts and primaries as in the adult. Sides under the wings narrowly fusco-plumbeous, the lengthened feathers over the flanks variegated with white. Entire under parts otherwise white; this color extending far around on the sides of the upper neck, nape and occiput.

Considerable variation in plumage as well as in size, and to a degree, in shape of bill, is exhibited by the numerous specimens examined. The differences in the bill are chiefly those of size, the relative proportions of the various measurements being pretty constantly preserved. The bill is always slenderer, and usually longer than that of *antiquus*, approaching in this respect the bills of the true *Brachyrhamphi*. The size of the whole bird varies somewhat, but not to any remarkable degree. In apparently equally adult specimens, the two series of white feathers, which form conspicuous stripes on the sides of the vertex and nape, vary much in length. Sometimes they spread
1868.]

out on the sides of the hind-neck to almost as great an extent as is witnessed in the most highly plumaged specimens of *antiquus*; again they may stop abruptly on the occiput, or at least on the nape. The comparative amounts of dusky and plumbeous on the upper parts is various, as is also the intensity of either of these hues. Thus a specimen, (No. — Phila. Acad., from Japan,) has the upper parts including the wing coverts bluish ashy, or bluish plumbeous, light enough to form a marked contrast with the band of nearly black which crosses the nuchal region, and descends on either side under the wings. In this specimen, also, the bill is blackish, although it is evidently an adult bird, having a crest an inch long. There is sometimes much white on the eyelids, sometimes none. The outline of the white on the sides of the hind head and of the neck varies; the younger the bird, the more the white encroaches on these parts.

It is not ascertained positively that the crest which so strongly characterizes perfect specimens of this species as a constant feature, that is, obtained at a certain age, and ever afterwards worn. Very possibly, it is only assumed during the breeding season; and falls off afterwards, so that perfectly adult winter specimens may be without it. It is at all events not to be enumerated among the infallible diagnostic points of the species.

Compared with *S. antiquus*, the species is at once distinguished, when in adult breeding plumage, by the presence of a crest, and the different extent of the white stripes and streaks upon the head, nape and neck. (Consult descriptions above given.) These differences aside, it is a larger bird, on an average, though some specimens do not exceed in size some examples of *antiquus*. The bill is slenderer, though not necessarily longer, more acute at the tip, comparatively not so deep at the base, and rather less compressed, the culmen, rictus and gonyx straighter. The identification of very young birds, however, is sometimes attended with difficulty; and some specimens in the present collections cannot, in fact, be satisfactorily determined. This state of affairs, however, is by no means unparalleled in other cases of perfectly distinct species; and by no means militates against the belief in the specified distinction of the two birds now under consideration. The adults cannot by any possibility be mistaken for each other.

This species is well represented in all its variety, by numerous specimens in the collections of the Philadelphia Academy and the Smithsonian Institution; though not contained, as far as heard from, in any other American cabinets. It is of frequent occurrence on the coasts of the North Pacific, and appears to be particularly abundant in the vicinity of Japan, whence most of the specimens described or recorded have been obtained. Its occurrence on the coast of the United States is open to question. Several specimens of *S. antiquus* (at least of the bird described in this paper under this name) are in our collections from Washington Territory, labelled "*Brachyrhamphus Temminckii*," and these appear to represent the species whose habits, etc., are alluded to by Drs. Cooper and Suckley, volume twelve, part ii, of the Pacific Railroad Reports, (Nat. Hist. Wash. Terr. p. 287, above cited) under the name of *Brachyrhamphus Temminckii*. But the description there given is that of the true *Temminckii*, having been copied from Mr. Cassin's article on the "*Birds of North America*."

The name which heads this article has priority over "*Temminckii*" of Prof. Brandt, and is therefore to be adopted, though its barbarous character is, assuredly, a matter of regret. It varies in orthography with different writers.

BRACHYRHAMPHUS, Brandt.

Colymbus, Gmelin, S. N. i, 1788; in part; not of authors.

Uria, Latham, Ind. Orn. ii, 1790; in part; not of authors.

Cephus, Pallas, Zool. R. A. ii, 1811, in part.

Brachyrhamphus, Brandt, Bull. Acad. St. Petersburg, ii, 1837. Type *Colymbus marmoratus*, Gm.

Apobapton, Brandt, l. c. Same type.

Anobapton, Bonaparte, Comptes Rendus, xlii, 1856. Same type.

[Jan.

With the general habitus of *Uria* proper, but of much more delicate build, different pattern of coloration, and very small size. Bill small, slender, much shorter than the head, not longer than the tarsus, greatly compressed, acutely tipped; culmen gently curved, its ridge sharp, rictus nearly straight, gonys straight; tomial edge of upper mandible greatly inflected towards the base, notched near the tip. Nasal fossæ small and shallow, nearly filled with feathers, which mostly cover the extremely minute oval nostrils. Wings of ordinary length, very narrow, pointed, falcate, the secondaries extremely short. Tail of ordinary length, almost square, the feathers obtusely rounded. Feet very small, short, slender, and weak; tarsus scarcely compressed, variable in length, never longer than the middle toe without its claw (except in *brachypterus* ?) Outer and middle toes equal in length; the claw of the former much smaller than that of the latter; the inner very short, its claw not reaching the base of the middle claw. Claws small, weak, moderately curved, very acute.

The genus which comprises the Murrelets—to coin an English word, needed for the *Brachyrhamphus*,—is a very natural and strongly marked one. It comes nearest to *Uria* proper, from which, however, it is sufficiently distinguished, as will be seen by the above diagnosis. It contains four or five species, all inhabitants of the North Pacific, and more particularly of the west coast of North America. These may readily be diagnosticated as follows:—

Species:—(5.)

- I. Tarsus much shorter than the middle toe without its claw.
Upper parts blackish and chestnut, lower parts blackish and white..... 1. *marmoratus*.
Upper parts cinereous and white, lower parts pure white..... 2. *Wrangeli*.
- II. Tarsus just as long as the middle toe without its claw.
Under surface of wings white 3. *hypoleucus*.
Under surface of wings dusky..... 4. *Craveri*.
- III. Tarsus longer than the middle toe without its claw, (teste Brandt)..... 5. *brachypterus* ?

BRACHYRHAMPHUS MARMORATUS, (Gm.) Brandt.

Colymbus marmoratus, Gmelin, Syst. Nat. i, 1758, p. 583, No. 12. Based on the marbled guillemot, Pennant,* Arct. Zool. ii, p. 517, pl. 22, and Latham, Syn. vi, p. 336, pl. 96. Donndorff, Beitr. Zool. ii, pt. i, 1794, p. 870.

Uria marmorata, Latham, Ind. Orn. ii, 1790, p. 799. Stephens, Shaw's Gen. Zool. xii, 1824, p. 249. Bonaparte, Synopsis, 1828, p. 423.

Brachyrhamphus (Apobaption) marmoratus, Brandt, Bull. Acad. St. Petersburg, ii, 1837, p. 346. Cassin, Birds N. A. 1858, p. 915; in part. Description of supposed adult is that of *B. Wrangeli*.

Brachyrhamphus marmoratus, Gray, Genera Birds, iii, 1849, p. 644. Cooper and Suckley, Nat. Hist. Wash. Terr. 1860, p. 286, in part. Not the description of supposed adult, which is that of *B. Wrangeli*.

Anobaption (Brachyrhamphus) marmoratus, Bonaparte, Tabl. Comp. Pelagiens, Comptes Rendus, 1856, xlii, p. 774.

Cepphus perdis, Pallas, Zoog. R.-A. ii, 1811, p. 351, pl. 80.

Uria Townsendii, Audubon, Orn. Biogr. v, 1839, p. 251, pl. 430; octavo ed. vii, 1844, pl. 475. The figure of the supposed young is the adult; that of supposed adult may be really *B. Wrangeli*.

* "With a black bill; crown dusky; throat, breast, and belly mottled with black and white; back and sides very glossy, and marbled with black and rust-color; wings dusky; greater coverts edged with white; tail black; legs yellow; webs black. Length 9 inches." Pennant, l. c. From Prince William Sound. Of this species, Vieillot, (Nouv. Dict. xiv, 1817, p. 36,) not exhibiting great sagacity, remarks, that it is "une jeune guillemot grylle, qui commence à prendre la livrée de l'adulte!"

† *Uria brevirostris*, Vigors,* Zool. Journ. iv, 1828, p. 357, and Zool. Beechey's Voy. Blossom, 1839, Ornith, p. 32. Evidently a young bird; may be of this species, or of *B. Wrangeli*.

† *Brachyrhamphus kittlitzii*,† Brandt, Bull. Acad. Sc. St. Petersburg, ii. 1837, p. 346. Young bird; may be of this species, or of *Wrangeli*, or a distinct species.

Coasts and Islands of the North Pacific. On the American side, south in winter to California; breeds as far south as Vancouver's Island. Numerous specimens in Mus. Acad. Philada., Mus. Smiths. Inst., Cab. G. N. Lawrence.

Form typical of the genus as just described. Bill along culmen just the length of the tarsus, tarsus scarcely three-fourths the middle toe without its claw.

Adult, breeding plumage. (Description from No. 49655, Mus. Smiths. Inst., ♂, June 9, 1867, Vancouver's Island.† Bill black. Tarsi posteriorly and both surfaces of the webs blackish; legs anteriorly and toes superiorly livid flesh color, or dull bluish gray. Iris brown. Entire upper parts brownish black, everywhere transversely barred with chestnut brown, or bright rust color, except on the wings, which are uniform brownish black, the primaries darkest, their inner webs brownish gray towards the base. Under surface of wings smoky brownish black. A few whitish feathers variegated with chestnut and dusky on the scapulars. Entire under parts, including sides of head, neck and body, marbled with sooty brownish black and white. The feathers are white, with the tips of the dark color. The white rather predominates on the middle of the breast and belly, the dusky on the other parts; the latter color being nearly uniform across the throat, and on the long feathers of the sides and flanks.

Specimens vary a great deal in the precise amount of rusty brown on the upper parts, and of dusky mottling on the lower; but, so far as known, are never without this distinctive coloration in some degree; and it becomes heightened at the breeding season.

Length about 10.00; extent about 18.00; wing 5.00; tail 1.50; tarsus .70; middle toe 1.00, its claw .20; outer toe and claw 1.15, inner do. .90; bill along culmen .70, along rectus 1.35, along gonys .55, height opposite base of nostrils .25, width at same point .20.

This species was originally described by Pennant as the Marbled Guillemot, whence *Colymbus marmoratus*, Gm. His description is that of the adult, in breeding plumage, but has been almost universally supposed to refer only to the young; and a very different species has been usually held to be the adult, as shown in the next article. It is also evidently the *Cephus perdis* of Pallas.

* "U. supra griseo-fusca, capite, dorsoque albo notatis; subtus alba, fusco undulatis maculata, rectricibus albis, duabus mediis fusco-notatis, rostro brevi, gracili.—Alae supra et infra, tectricesque inferiores fuscae. Rostrum nigrum. Pedes flavi, membranis unguibusque brunneis. Longitudo corporis 9; rostri ad frontem $\frac{1}{2}$, ad rectum $1\frac{1}{2}$, alae $\frac{3}{4}$; caudae 1; tarsi $\frac{1}{2}$." Vigors, l. c. From San Blas.

† "Supra cinerea nigricante et pallide e fusco-flavescente undulata et submaculata. Subtus alba, subfuscescente tenuissime lavata, nigro et quidem in pectore frequentius undulata. Alae e cinerascante et fusco nigrae. Rostrum brevissimum, capitis longitudinis tertiam partem circiter aequans. Tarsi digito medio breviores. Longitudo a rostri apice ad caudae apicem 9. Patria Kamtschatka."—Brandt, l. c.

‡ The following is an extract from a letter to Prof. Baird, from J. Hepburn, Esq., dated Victoria, Sept. 5, 1867, which accompanied a lot of specimens of which No. 49655 was one. It confirms the views maintained in the present paper, and gives some interesting facts: "You will find in the box a specimen of *B. marmoratus*. On comparing it with Mr. Cassin's description, (in Birds N. A.) I find it is what he calls the young bird. In this he is mistaken. In the first place, if such were the case we should see some red birds among the large numbers that are to be found here, whereas till this year I never saw but one specimen. * * * In the next place, when I fell in with them last May, every bird was in the red plumage, including the one which, as I told you, would have laid an egg in two or three days; and lastly, proof conclusive, I have shot the young bird, two-thirds grown, in the winter plumage of the adult, except that the breast is more thickly barred than in any specimens I have seen in the winter, and at the very time the adults were in their red plumage."

Audubon's figure and description of the supposed young of this bird, under the name of *Uria Townsendii*, is really that of the adult. His figure of the supposed adult appears rather to represent *Wrangeli*.

It is difficult, perhaps impossible, to determine *Uria brevirostris* Vigors. This is evidently, as far as can be judged by the description, a young bird. It belongs to the short-legged group of the present genus; but whether it is the young of *marmoratus* or of *Wrangeli*, is a point which cannot be decided. The expression "capite dorsoque albo-notatis," and the absence of any mention of rust-color in the description, would lead one to assign it rather to *Wrangeli*.

Brachyrhamphus Kittlitzi, Brandt, is another bird which has not been identified since its original description. Like *U. brevirostris*, it is evidently a young bird, of the short-legged group; and the expression "fusco-flavescente undulata" induces the presumption that it is really only a young *marmoratus*. But it is possible that both it and *B. brevirostris* may be the young of the same species, or of two different species, which yet remain to be identified. It is not probable, however, that either of these names represent valid species, distinct from each one of those recognized in this paper.

BRACHYRHAMPHUS WRANGELI, Brandt.

Brachyrhamphus Wrangeli, Brandt, Bull. Acad. St. Petersburg, ii, 1837, p. 344. "Rostrum capitis dimidii circiter longitudine. Caput supra, nucha et dorsum e nigricante grisea. Alæ et cauda nigre. Reliquæ partes, nec non stria longitudinalis supra alam, albæ. Tarsi digito medio breviores. Longitudine a rostro apice ad caudæ apicem 9½. Patria Insulæ Aleuticæ." Cassin, Birds N. A. 1858, p. 917. Copies Brandt's diagnosis.

Brachyrhamphus marmoratus, Cassin, B. N. A. 1858, p. 915, in part. Description of supposed adult *marmoratus* is that of *Wrangeli*.

Aleutian Islands, and north-west coast of America; south to Puget's Sound, and perhaps further. Numerous specimens in Mus. Smiths. Inst. (No. 11,457, perfectly adult, Puget's Sound, in February; No. 46,547, just fully fledged, Sitka; and others from same locality in various stages of adolescence; No. 46,542, Sitka, in January.)

Description (from No. 46,541, Mus. Smiths., perfectly adult male, Sitka, March, 1866).—With the size and proportions of the several members as in *marmoratus*; the bill absolutely shorter, relatively rather stouter. Bill scarcely as long as the tarsus. Tarsus much less than middle toe without claw.

Adult.—Entire upper parts, except the scapulars, very dark cinereous, the centres of the feathers, particularly on the back and rump, blackish, causing these parts to appear obsoletely waved with blackish and cinereous; the crown of the head, the wings and the tail, almost black, the larger wing coverts just appreciably white-margined; scapulars almost entirely pure white, forming two conspicuous broad longitudinal bands. Under wing coverts dusky brown; inner webs of the primaries the same, not fading, even at their extreme bases, into whitish. Entire under parts pure white, immaculate, except some dusky streaks on the long feathers of the sides and flanks. This white on the sides of the head invades the lores to the level of the top of the orbits, and extends into the nasal fossæ; then lowers a little, so that the eyes are left in the dark color of the top of the head; then on the nape extends almost to the median line, across which a few white feathers extend to the white on the other side, forming an imperfect nuchal collar; then extends in a straight line down the middle of the side of the neck. On the sides of the rump the white extends around so far, that the cinereous is only left as a band an inch wide. This white on the sides of the rump is as apparent upon the upper surface as that on the scapulars; it is directly continuous with that of the under parts, but on the flanks the long overlying cinereous feathers appear to separate it. Bill wholly black. Tarsi posteriorly and toes inferiorly blackish; rest of the feet, 1868.]

including both surfaces of the webs, probably flesh-colored in life; dull yellowish-white in the dried skin.

Length "10.00, extent 18.00" (collector's label); wing from carpus 5.00; tail 1.50; tarsus .70; middle toe without claw .92, its claw .20; outer toe and claw 1.10; inner do. .88; bill along culmen .60, along rictus 1.25, along gonys .45, its height at base of nostrils .22, its width at same point .19.

Young. (No. 46,547, Mus. Smiths., Sitka, July, 1866; just fully fledged; the bill has still the white horny knob at tip of upper and under mandible, showing the juvenility of the specimen).—Bill very small, weak, short, imperfectly developed, about a third as long as the skull; .45 along culmen; tarsus .55; middle toe and claw 1.00; wing only 4.25. Entire upper parts blackish, much darker than in the adult, with only a just appreciable shade of cinereous; the scapular white present, but restricted in extent, and interrupted by imperfect bars of dusky across the feathers. Entire under parts white. Everywhere, except on chin, middle of abdomen, and under tail coverts, thickly marked with delicate waved lines of dusky, most numerous across the throat, largest on the sides and flanks, where some of the longer feathers are mostly dusky, finest on the lower breast. The whitish on the sides of the head does not extend so far, and merges insensibly into the dark color; on the nape a delicate line of white feathers almost forms a collar. The under wing coverts are as in the adult. Bill blackish. Legs and feet anteriorly more dusky than in the adult.

Another specimen (No. 46,542, Mus. Smiths.), taken in January, marked female, and evidently hatched the preceding summer, has the size of the adult, and the colors generally as in the young bird just described. But the upper parts are much lighter and more decidedly cinereous, as in the adult; the scapular white well developed; the dusky waving of the under parts confined to the sides and throat. The under wing coverts are dusky along the edge of the wing; but are elsewhere variegated with dull whitish; only to a small degree, however, not approaching the condition seen in *hypoleucus*.

In mature plumage this is a very handsome bird, and recognizable at a glance by the pure white of the under parts, and blackish cinereous of the upper, relieved by the conspicuous white of the scapulars and sides of the rump. It belongs to the short-legged division of the genus, being very different from *hypoleucus* and *Craveri* in the proportions of the tarsus and toes. It has the size and form of *marmoratus* in every respect except a just fairly recognizable difference in the shape of the bill. But it is quite a different species from *marmoratus*; so different, in fact, that no special comparison need be instituted.

The recognition, in the bird here described, of *Brachyrhamphus Wrangeli*, Brandt, is a matter of unusual interest, identifying, as it does, a species long ago described, but almost unknown to ornithologists at large, and throwing light upon what has always been a very obscure point in American ornithology. The writer is mainly indebted to Prof. Baird's suggestions for the fortunate direction of his investigation in this case. The present species has hitherto been regarded and described by American writers as the *adult* of the well-known *marmoratus*, whose curious colors, as described by all authors from Pennant downwards, and as figured by Audubon under the name of *Uria Townsendii*, have always been considered as indicative of immaturity. But numerous specimens, in adult *breeding* plumage, demonstrate the falsity of this view, as is satisfactorily set forth in the preceding article. Beyond the possibility of a doubt, the present species is not *marmoratus*; and it is certainly *Wrangeli* of Brandt.

BRACHYRHAMPHUS HYPOLEUCUS, *Xantus*.

Brachyrhamphus hypoleucus, Xantus, Proc. Acad. Phila. Nov., 1859. From Cape St. Lucas. Baird, eodem loco.

Coast of California. Specs. in Mus. Smiths., and Mus. Acad. Philada. So far south, in summer, as Cape St. Lucas, Lower Cal.

[Jan.

Description (from No. —, Mus. Smiths., ♀, San Diego, Jan. 27, 1862; a typical example).—Bill along culmen half as long as the skull, three-fourths as long as the tarsus, as long as the middle toe and half its claw, very slender, much compressed, higher than wide at the base; culmen gently curved its whole length; rictus nearly straight; gonys perfectly straight; outline of the very slender mandibular rami a little concave. Tarsus just as long as the middle toe without its claw! Tip of inner lateral claw not reaching base of middle one. Wings and tail of usual shape; the latter contained about two and a third times in the length of the former from the carpus. Under tail coverts reaching (in this specimen) just beyond the end of the tail. Entire upper parts uniform cinereous, not varied by white. This color is slightly darker, and more blackish-plumbeous on the head. It extends on the sides of the head just to the eyes, the lids of which are of this color, a little further down on the auriculars; thence in a straight line along the middle of the side of the neck to the shoulders; thence in a straight line along the sides under the wings, where it is nearly an inch broad; the elongated feathers of the flanks are also mostly of this color. Other under parts entirely pure white. Under surface of wings entirely pure white! Primaries black on the outer web; the greater part of the shaft and inner webs white; the terminal portion of the shaft and inner webs brown. Tail feathers black, the inner webs somewhat brownish. Bill black, the base of the lower mandible whitish; feet anteriorly dull yellowish, posteriorly dusky, in the present dried state; "bill black, feet whitish-blue, black below" (label).

"Length 10.50; extent 17.50" (label); wing 4.80; tail 1.70; tarsus .95; middle toe without claw .95, its claw .20; outer toe and claw 1.10; inner do. .90; bill along culmen .80, along rictus 1.30, along gonys .45; depth at base .22; width .19.*

The specimen above described, collected at San Diego, Cal., by Dr. J. G. Cooper, is a little larger than the type, as will be seen by comparing the measurements with those in the accompanying foot-note. It is also described as representing the perfect plumage,—the type being imperfect in this respect. The upper parts are of a uniform very dark cinereous, without a shade of brown; the latter hue only occurring in specimens with worn and faded plumage. In the original description, here appended, the indications of the size of relative lengths of the tarsus and middle toe are made without reference to the claw; which fact explains an apparent discrepancy between the present description and the original one. The tarsus is exactly as long as the middle toe without its claw.

This is a very strongly marked species. The most striking diagnostic feature is the pure white of the under surface of the wings. In the uniformity of the cinereous color of the upper parts it is also unique. Nearly the same length of tarsus is found in *B. brachypterus*, Brandt, and *Craveri*, Salvadori; the tarsus is much shorter than the middle toe in *Wrangeli* Brandt, *marmoratus* Gm., "*Kiullitzi*" Brandt, and "*brevirostris*" Vigors.

This species is certainly not the *Uria brevirostris* Vigors, from San Blas. This is described as having "aë suprà et infrà, tectricesque inferiores fuscae,

* * tarsi $\frac{1}{2}$," which settles all questions on this score. It has the same dimensions, and the same relative length of tarsus and toes as *Craveri* Salva-

* The following is the original description of the type specimen: "Bill slender and slightly curved, about half the length of head. Tarsus scarcely shorter than the middle toe [and claw]. Above dark brownish-black, the edges of the feathers with a decided plumbeous tinge; the side of neck below, and the axillars with the concealed portion of the sides of the breast, ashy plumbeous. Entire under parts, including tail coverts and inside of the wings, pure white, this color extending on the sides of the head so as to include the eyes; the lids, however, are tinged with dusky; bill black; legs apparently reddish in life.

"Length 10 inches, extent 15.80, wing 4.70, tail 1.80, bill above .70, gape 1.20, tarsus .85, middle toe [with claw] 1.00. This specimen is considerably weather-beaten, and the old feathers of the upper parts are much worn, and bleached at the edges. The new ones are, however, as described."

dori, also from the coast of Lower California; but the latter appears to be a different species, as will be discussed further on. It comes nearest to *brachypterus*, from Unalaschka; in fact there is nothing in Brandt's brief diagnosis preventing the reference of the present species to *brachypterus*, except the expression "tarsi digito medio longiores." But in view of this discrepancy, and of the widely-separated localities whence the two species are described, it would be unsafe to take their identity for granted. It is much the best course to retain the present species as it stands, under the name *hopoleucus*, which has the merit of being positively identified, as is not the case, as yet, with *brachypterus*.

Several excellent examples of this species from various points along the coast of California are in the collections of the Smithsonian Institution and Philadelphia Academy. They present no individual differences worthy of special mention; except in the instance of the type specimen, which is brownish above, from the faded and worn condition of the plumage.

This species has probably the southernmost range of any of the family; occurring in summer at Cape St. Lucas. It was observed by the writer in December, 1865, off the coast of Mexico, about latitude 21° N. Its extension northward remains to be ascertained. At present, it is not known to occur north of the coast of Lower California. Its southern habitat, as remarked by Prof. Baird, is a fact of great interest, when it is recollected how truly boreal are nearly all the species of the family.

BRACHYRHAMPHUS CRAVERI, (Salvad.) Coues.

Uria Craveri, Salvadori, Descrizione di altre Nuove specie di Uccelli esistenti nel museo di Torino, 1867, p. 17. Estratto dagli Atti della Società Italiana di Scienze Naturali, vol. viii, 1866.

"*Jun.*—*Uria* minima, crassitie *Merguli alle*; suprà fusco-nigra, dorso ac alis nonnihil griseo-tinctis. Subtus alba; rostrum valde elongatum, subulatum, nigrum; tarsi postice nigri, antice viride-luteis; unguibus nigris.

"Long. tot. 0,245; al. 0,125; caud. 0,018; rostri a rictu 0,037; tarsi 0,022; dig. med. cum ungue 0,024; (millimetres.)

"Parti superiori, lati della testa, le piume del mento lungo il margine inferiore della mandibula, lati del collo, del petto, e fianchi di color bruno-nero con una leggera tinta grigio-lavagna sul dorso, sul groppone e sulle ali; parti inferiori candide; becco nero; tarsi neri posteriormente, anteriormente giallo verdastri come anche le dita; unghie neré.

"Questa specie sarebbe comune lungo le coste del Golfo della California, e nell' Isola della Natividad posta nel Pacifico, a poca distanza dalla costa occidentale della Bassa California."—Salvadori, l. c.

This recently described species has much the same habitat as *B. hypoleucus*, and very much resembles the latter. The dimensions are the same in both, and the colors are very nearly alike. The expression "fusco-nigra, * * griseo-tinctis," exactly hits some specimens of *hypoleucus*,—those somewhat faded and worn in plumage,—though not applicable to more perfect specimens. In the above copied description, no mention is made of the under surfaces of the wings; but the needed information in this regard has been supplied through a private channel. Prof. Baird has received from Sig. Salvadori, and kindly transmitted to the writer, a life-size figure of the bird, accompanied by a note in which it is stated that "the lining of the wings is blackish, and some feathers are white-edged." This fact at once distinguishes the species from *hypoleucus*, providing the latter, in all stages of plumage, has the under surfaces of the wings white, as is most probable, judging by what is known of the variations in plumage of the birds of this genus.

Waiving the bare possibility of this bird's being a young *hypoleucus*, it cannot be referred to any described species, and must be regarded as a valid one. That it is not *brevirostris*, Vigors, is sufficiently evident from the dimensions; the tarsus of the latter being only half an inch long.

[Jan.

BRACHYRHAMPHUS BRACHYPTERUS, Brandt.

Brachyrhamphus brachypterus, Brandt, Bull. Acad. Imper. St. Petersb. ii. 1837, p. 346. Quotes "*Uria brachyptera* Kittlitzii, MSS." Gray, Genera, iii, 1849, p. 644. Cassin, Birds N. A. 1858, p. 917. Merely copies Brandt's description. *Anobapton* (*Brachyrhamphus*) *brachypterus*, Bonaparte, Tab. Comp. Pelagiens, Comptes Rendus, xlii, 1856, p. 774.

"Suprà cinerea, alis caudaque nigricantibus. Collum subtus et in lateribus, pectus et abdomen alba. Rostrum capitis dimidii circiter longitudine. Tarsi digito medio longiores. Longitudine a rostri apice ad caudæ apicem 9. Patria Unalaschka."—Brandt, l. c.

This species is wholly unknown, at least on this side of the Atlantic, except by the above cited description of Brandt. It has nothing to distinguish it from some other *Brachyrhamphi* except the length of the tarsus. This, however, if it really obtains, is sufficient to distinguish the bird from all others, not only of the genus, but of the family; for no known alcidine bird has the tarsi longer than the middle toe.

URIA, (Mochr.) Brisson.

Columba sive *Columbus*, Auct. antiq. ex parte. *Vria*, Moehring, Av. Gen. 1752, p. 67, No. 73. Type *Columba groenlandica*, Willoughby.

Uria, Brisson; Brünnich, Orn. Bor. 1764; and of authors generally.

Alca, Linnæus, Syst. Nat. i, 1758; in part.

Colymbus, Linnæus, S. N. i, 1766, in part, and of many of the older authors.

Cephus, Pallas, Spic. Zool. v. 1769, in part.

Grylle, Brandt, Bull. Acad. St. Petersb. ii, 1837, p. 346. Type *U. grylle*, Brünn.

Bill much shorter than the head, about equal to the tarsus, straight, rather stout, moderately compressed; culmen at first straight, then rapidly deflected; rictus straight, except just at tip; gonys ascending, straight, short, about half as long as the culmen. No groove in sides of upper mandible near its tip; commissural edge of upper mandible scarcely inflected. Nasal fossa wide, long, deeply excavated, partially bare of feathers, which do not wholly obstruct the nostrils. Feathers extending on sides of lower mandible with a salient rounded outline. Wings and tail very short, the latter contained about two or two-thirds times in the length of the former from the carpal joint to the end of longest primary; tail slightly rounded. Tarsus much compressed, entirely covered with polygonal reticulations, somewhat scutelliform on the inner aspect; slightly shorter than the middle toe without its claw. Outer and middle toes equal in length; the claw of the former much smaller than that of the latter, tip of inner claw just reaching base of middle one. Claws compressed, moderately arched and acute; the outer one grooved along its outer aspect, the middle one greatly dilated along its inner edge. No postocular furrow in the plumage.

In the preceding diagnosis the characters of the genus are so drawn as to exclude the large species of *Lomvia*. Few writers have made this generic distinction, for which, notwithstanding, there is abundant reason, as may be seen upon a critical comparison of the two types of form; and as will be satisfactorily demonstrated at length under head of *Lomvia*. It need only be noted here, that the structure of the bill and feet are in many respects very different in the two genera.

The genus as here framed comprehends three distinct species, intimately allied to each other.

Species :—(3.)

Disregarding other and less prominent though very valid distinctions, the three species of *Uria* may be at once recognized by the following characteristics :—

1868.]

- A large white space on wing, entire. No white about head 1. *grylle*.
 A large white space on wing partially divided by a black line. No white about head..... 2. *columba*.
 No white on wing. Feathers around and behind eye and at base of bill, white..... 3. *carbo*.

Or they may be still more briefly and quite as satisfactorily characterized thus :—*carbo*—upper and under surfaces of wings black ; *grylle*—upper and under surfaces of wings white ; *columba*—upper surfaces of wings white, under black.

The division of the white mirror on the upper surface of the wings of *columba* is not the most important point of coloration, though the most obvious, upon casual inspection, by which the species differs from *grylle*. A still stronger diagnostic character lies in the absence of white on the under surface of the wings.

URIA GRYLLE, (Linn.) Brünn.

- Columba groenlandica*, "Linnæus, Syst. Nat. vi, ed. 1746, p. 23, No. 4. *Albanus*, Av. ii, p. 73, pl. 88. Ray, Syn. Av. p. 121, No. 6. Willoughby, Orn. p. 245, pl. 78. Martens, Spitzburg. p. 56, pl. 50, fig. B."
Columbus groenlandicus, "Klein Av. p. 168, No. 2."
Uria groenlandica, Brünnich, Orn. Bor. 1764, p. 28, No. 116, (blank.)
Uria nigra, striata, et minor, Brisson.
Alca grylle, Linnæus, Syst. Nat. i, 1758, p. 130. Schlegel, Urinatores Mus. Pays-Bas. livr. ix, 1867, p. 130, excl. synonym. *Cephus columba*, Pall.
Colymbus grylle, Linnæus, Syst. Nat. i, 1766, p. 220. Hermann, Tabl. Affin. Anim. p. 148. Blumenbach, Handb. Naturg. p. 220 Müller, Zool. Dan. Prodr. p. 18. Gmelin, Syst. Nat. i, 1788, p. 584. Donndorff, Beytr. Zool. ii, pt. i, 1794, p. 871. Several states of plumages enumerated as varieties.
Uria grylle, Brünnich, Orn. Bor. 1764, p. 28, No. 113. Latham, Ind. Orn. ii, 1790, p. 797, No. 2. Var. "B," is *columba* ; perhaps also var. "E," the same. Temminck, Man. Orn. ii, 1820, p. 925. Vieillot, Gal. Ois. ii, 1825, p. 235, pl. 294. Bonaparte, Syn. B. N. A. 1828, p. 423. Audubon, Orn. Biog. iii, 1835, p. 148, pl. 219 and B. Amer. vii, 1844, p. 474. Peabody, Rep. Nat. Hist. Mus. 1840, Birds, p. 399. Gray, Genera Birds iii, 1849, p. 644. Thompson, Nat. Hist. Ireland, iii, 1851, p. 214. Macgillivray, Hist. Brit. Birds, 1852, ii, p. 331. Cassin, Birds N. A. 1858, p. 911, pl. 96, fig. 2 ; and Pr. A. N. S. Philada. 1862, p. 323. Herald Island. Bryant, Proc. Bost. Soc. Nat. Hist. May, 1861, p. 74. Coues, Pr. A. N. S. Philada. 1861, p. 225. Verrill, Proc. Bost. Soc. Nat. Hist. 1862, p. 131, and p. 142, and Proc. Essex Inst. iii, 1863, p. 160. Samuels, Ornith. and Ool. New Engl. 1867, p. 567.
Uria (Grylle) grylle, Brandt, Bull. Acad. St. Petersb. ii, 1837, p. 346.
Uria (Cephus) grylle, Bonaparte, Comptes Rendus, 1856, xlii, p. 774.
Cephus grylle, Fleming, Hist. Brit. Anim. 1842, p. 134.
Cephus lacteolus, Pallas, S. Z. v, 1769, p. 33. Albino, perhaps *columba*.
Colymbus lacteolus, Gmelin, Syst. Nat. i, 1788, p. 583. Albino. "C. niveus, rostro pedibusque ex carneo fuscescentibus." Donndorff, Beytr. Zool. ii, pt. i, 1790, p. 870.
Uria lacteola, Latham, Ind. Orn. ii, 1790, p. 798. Albino.
Uria grylloidea, Brünnich, Orn. Bor. 1764, p. 28, No. 114. Changing plumage.
Uria balthica, Brünnich, Orn. Bor. 1764, p. 28, No. 115. Immature or winter.
Uria nivea, Bonaparte, Ency. Method. Orn. 1790, p. 37. Albino, possibly of *columba*. Quotes Pall. Spec. Zool. v, p. 33.
Uria leucoptera,* Vieillot, Nouv. Dict. d'Hist. Nat. xiv. 1817, p. 35.

* "Cet oiseau, dont je ne connais pas le pays natale, est totalement d'un noir profonde, avec une grande plaque blanche sur l'aile ; sa taille est à peu près la même que celle du précédent," (*U. troile*)—Vieill., l. c.

Uria unicolor, Faber, Prodr. Isl. Orn. 1822, p. teste Schlegel. Greenland. without white on wings.

Uria (Lomvia) unicolor, Bonaparte, Comptes Rendus, 1856, xlii, p. 774.

Uria Mandtii, Lichenstein, Verz. 1823, p. 88, teste Schlegel. Spitzbergen.

Not of authors, which usually refers to *columba*.

Uria scapularis, Stephens, Shaw's Gen. Zool. xii, 1824, p. 250, pl. 64.

Cephus glacialis, arcticus, Faroensis, et Meisneri, Brehm.

European and American coasts and islands of the North Atlantic; very abundant. Arctic Ocean. Spitzbergen, Iceland, Greenland. On the American coast, in winter, south to New Jersey coast. Rare or accidental in the north Pacific, where replaced by *columba* and *carbo*.—? Kamtschatka, (Mus. Pays-Bas, fide Schlegel.)* Herald Island, Arctic Ocean, (Cassin, Pr. A. N. S. Ph. 1862, p. 323); Spec. in Mus. Acad. Phila., Smiths. Inst., Bost. Soc. Nat. Hist.; Essex Inst.; Cab. G. N. Lawrence; author's Cab.

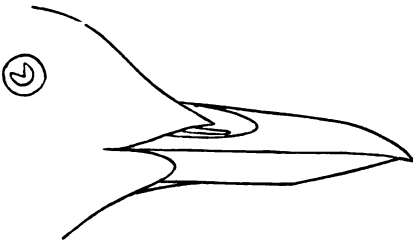


Fig. 13.—*Uria grylle*.—Nat size.

This perfect breeding plumage is temporary, and lasts but a short time. Very many individuals do not assume it until June; and it is usually retained only during this and the succeeding month. Most specimens collected in May are found to still have some traces of the winter plumage, below described.

Adult, during autumnal change. The first indication of the moult is seen in the wings and tail, and is to be observed in nearly all specimens taken after July. By the latter part of this month, after incubation and nursing are finished, the wing and tail feathers become much worn, and faded, turning to a light brownish gray towards their tips. The white mirror shows scattered traces of dull brown. The body color loses its hue of green, and becomes more fuliginous brown. Isolated white feathers are scattered over the whole body; or the dark feathers acquire white tips. With the falling of the quill feathers, which may take place very rapidly, and deny for a season all power of flight, the bird is in the following condition, which is the pure *moulting* state, exactly intermediate between the summer and winter plumages:—No. 18254, Mus. Smiths., Labrador, Aug. 14, 1860. E. Coues. Wing feathers renewed, pure black, but not fully grown; wing from the carpus only 4.50 long. Mirror of renewed feathers, almost or quite pure white, but small; under wing coverts and axillars pure white. Head and neck all around, rump, and whole under parts marbled with black and white in equal quantity, the bird looking as if dusted over with flour. Back black, most of the feathers lightly bordered with white, the scapulars more largely white. A still further increase of white produces the following:—

Adult, winter plumage.—Wings and tail black, the mirror and under wing coverts faultlessly white. Head and neck all around, rump and entire under

Adult, summer plumage.

—Bill and claws black
Mouth, legs and feet brilliant vermilion red, tinged with carmine. Entire plumage plumbeous or fuliginous black, with a tint of invisible green. Wings and tail pure black, the former with a large oval space on the upper coverts, all the under coverts and the subscapulars pure white.

* Although this author does not recognize the specific validity of *U. columba*, and would therefore range specimens of the latter under *grylle* in his catalogue, a specimen (No. 5.) there enumerated appears to be this species, as is inferrible from the expression "Au miroir d'un blanc pur."

parts pure white; the back, (and frequently the crown, and back of neck,) black, more or less variegated with white. Audubon figures this condition very nearly.

The change in spring—mostly occurring during April and May—is the reverse of that already described as the autumnal moult.

Fledgelings.—(Labrador, July, 1860, E. Coues, Mus. Smiths. No. —.) Length about 6·00; bill ·50; tarsus ·60; middle toe and claw ·90, etc. Wholly covered with soft wooly puffy down, fuliginous brownish black; bill and feet brownish black.

Young, first plumage.—Traces of the down on various parts of the body; the bird probably just beginning to fly; length about 10·00, wing 11·50; bill 1·00, black; tarsus 1·25; reddish dusky, as also are the toes. Upper parts plumbeous or sooty black, scarcely varied with white. Mirror beginning to appear, as white spotting on a blackish ground. Entire under parts white, thickly marbled, rayed and undulated with light touches of dusky.

This state tends to pass directly into a condition exceedingly similar to, if not identical with, that of the adults in winter. But birds of the first winter may, at least early in the season, be distinguished from old ones by a certain "feel" of the plumage, and a shorter, weaker bill, less developed as to its ridges and angles.

Accidental variations.—The foregoing descriptions apply to the various stages of plumage, which are strictly normal in character, and which, though unending in precise degree, and varying with almost every individual, merge insensibly into each other. The species is, however, also very subject to accidental and entirely abnormal variations. Of these, albinism is the most common. (Spec. in Mus. Acad. Philada.) Entirely milk white, without a trace of black; bill and feet light colored; eyes probably pink in life. The opposite condition of melanism is described by authors. This consists in the total absence of white on the wings; and is apparently of infrequent occurrence. Both these conditions have been described and named as characterizing distinct species. In the latter, the bird must not be confounded with *Uria carbo*, which is totally different.

Dimensions.—Adult: Length, (average) 13·00; extent, (average) 22·50; wing 5·50 to 6·25; tail 2·00, a little more or less; bill along culmen 1·30; along rectus 1·75; along gonys ·65; depth at base ·45, width ·35; tarsus 1·25; middle toe and claw 1·75, outer do. slightly less, inner do 1·40.

It may be of advantage to look closely into the formation of the white area upon the wing of this species, to the end that its composition may be clearly understood, and recognized as different from that which obtains in the allied species, *U. columba*. The mirror upon the upper coverts varies to a degree, and in a precisely similar way, in each species; but when perfect constantly presents a radical difference.

When *Uria grylle* is observed flying, as is its wont, low over the water with rapid beats of the wings, the eye receives the impression of a black bird, with a large white circular spot on the wing. This spot is constantly in view, and represents the retinal image resulting from the white spaces upon both the upper and under surface of the wings blended together by the rapid motion of the wings. Those who have observed *Uria grylle* in its native haunts will appreciate the pertinence of this remark. *Uria columba* presents no such peculiarity of appearance, there being no white upon the under surface of the wings; and the eye readily follows the movement of the small white space upon the wings, as with the changing attitudes of the bird, it is now apparent, now lost to view.

In *Uria grylle*, the row of great coverts upon the secondary quills are basally black, terminally white. The outermost are white for rather less than half their length, and the white occupies chiefly the exterior webs. Nearer the body they are white for more than half their length, and the white occupies both webs of the feathers.

[Jan.

The next row of coverts are wholly white in their entire length, except perhaps for a very brief space just at their base; and they are throughout long enough to cover entirely the dark portion of the first row, reaching a little beyond and overlying the commencement of the white upon the latter; so that the white is continuous and unbroken. One or two more rows of coverts have precisely the same character and continue the white space uninterrupted.

The shorter coverts, for about half inch from the edge of the antibrachium are black. The last of these, however, are broadly tipped with white, which white portion overlies the extreme bases of the next row, blending its color with that of the latter; the anterior edge of the mirror being thus the line of union of the black and white portions of these coverts, taken collectively.

In *Uria columba*, the row of great coverts is externally wholly black, or at most the outermost feathers have only a very narrow white tip. The amount of white on the feathers increases rapidly from without inwards, until on the innermost there is nearly or quite as much white as in *grylle*. In consequence of the small amount of white on these coverts, the next row of coverts do not overlie, nor even reach it; there being left a broad space of dusky between the white tips of the second row of coverts, and those of the first; which space rapidly diminishes from the edge of the wing towards the body, forming the curved crescent of dusky which is obvious upon the wing of this species.

The mirror of *Uria grylle* is subject to much variation, which, however, never obscures its distinctive characters in any decided degree. The greater coverts may be wholly dusky; then the mirror is the same as before, except in its smaller size; the next row may be tipped with dusky, so that no white comes forward to coalesce with that of the greater row, and an appearance like that of *columba* is produced; which need not deceive, since the dusky results from the second row of coverts instead of the first. All the wing coverts may be tipped with dusky; producing a variegated or spotted mirror. Finally, the mirror may be only indicated by a few isolated white feathers, or may be altogether wanting.

It is to be borne in mind, that the difference in the mirror of *U. grylle* and *columba* is only one of the most obvious, but not the most specific distinction. In the very possibly occurring cases in which there is absolutely no difference between specimens in this respect, the absence of the white under the wing, and the shape of the bill, readily distinguish *columba* from *grylle*.

Perhaps no bird has so many synonyms as *Uria grylle*. Independently of its reference to divers genera, a large number of nominal species have been instituted upon its various stages of plumage, some of them requiring brief notice. A very common name for the species among pre-Linnæan writers was "*Columba groenlandica*,"—obviously a mere rendering into Latin of a popular designation. The word "*grylle*" made an early entry into the records, designating the adult plumage. *Grylloides* of Brünnich represents a variegated condition; and *balthica* of the same author an immature or winter state. *Lactolus* of the older authors seems to have been based upon the albino condition; the bird being described as "*niveus, rostro pedibusque ex carneo fusciscentibus*." It is possible that Pallas, who introduced the word, may have really based it upon a specimen of *columba*; but this is a point of no special consequence. Bonnaterre has another name,—"*nivea*"—for the same condition, quoting Pallas, Sp. Z. v, p. 33. Brisson and Brehm both have a large number of nominal species, not necessary here to particularize. In 1817, Vieillot (l. *suprà* cit.) describes an adult under the name of *Uria leucoptera*, erroneously assigning it dimensions nearly equal to those of *Lomvia troile*. At least the presumption is that this *leucoptera* is nothing but a large *grylle*, though he must have been perfectly familiar with the latter. Even so late as 1824, *grylle* is redescribed as *Uria scapularis*.

The "*Uria Mandtii*" of Lichtenstein requires attention, having been extensively quoted as a synonym of, or employed to designate, *U. columba*, as will 1868.

be seen by the list of synonyms under head of this species. It is not possible to determine from the description whether *Mandtii* is really based upon *columba* or upon *grylle*. But Dr. Schlegel describes a specimen from Spitzbergen in the Mus. Pays-Bas.—“un des individus types de l'*Uria Mandtii* de Lichtenstein, obtenu du Musée de Berlin,” as having the white feathers of the mirror tipped with clear brown, and the wing and the tail feathers faded grayish. This is a common condition of autumnal specimens of *grylle*; and the description does not point more particularly to *columba* than to this species. Upon the whole, it may be best to regard *Mandtii* Licht. as a synonym of *grylle*; though the name as used by Brandt, Bonaparte and some others refers unmistakably to *columba*.

A certain *Uria unicolor* is described by Faber and Benecken and admitted as distinct in the Comptes Rendus for 1856, by Bonaparte, who moreover places it in a different subgenus from *grylle*. Bonaparte does not use the term to designate *carbo* Pall., which latter he gives as distinct. The name seems to have been based upon the melanotic state of plumage of *grylle*. Dr. Schlegel describes, in the ninth livraison of the Mus. Pays-Bas Catalogues, one of Faber's type specimens from Greenland, as being “Au plumage d'un noir enfumé absolument uniforme.”

URIA COLUMBA, (Pallas) Cassin.

Black Guillemot, variety from Kamtschatka, “with a white oblique line issuing from the white spot on the wings,” Pennant, Arct. Zool. ii, 1785, p. 517.

Uria grylle, var. B, Latham, Ind. Orn. ii, 1790, p. 797. “*Fuliginosa, fascia alarum gemina alba*. Lath. Syn. vi, p. 333, No. 3, var. a. Habitat in Aoonalashka.”

Colymbus grylle, var. B, Donndorff, Beytr. Zool. ii, pt. i, 1794, p. 872. Quotes Latham and Pennant.

Cephus columba, Pallas, Zoog. R.-A. 1811, ii, p. 348. “In speciminibus orientali oceani, fascia alarum duplex,” etc. (p. 349.)

Uria columba, Cassin, Voy. Vincennes and Peacock, Orn. Atlas, pl. 38, fig. 1. Idem, Baird's B. N. A. 1858, p. 912, pl. 96, fig. 1. Idem, Pr. A. N. S. Phila. 1862, p. 323. Heermann, Pac. R. R. Rep. x, 1859, Route to California, Birds, p. 76. Cooper and Suckley, Pac. R. R. Rep. xii, pt. ii, 1860, p. 285.

?? *Uria mandtii*, Lichtenstein, Verzeich, 1823, p. 88.

Uria mandtii, Reichenbach, Vollst. Naturg. Schwimmvög, pl. 4, fig. 47. Gray, Genera Birds, iii, 1849, p. 644.

Uria (Grylle) mandtii, Brandt, Bull. Acad. St. Petersb. ii, 1837, p. 346.

Uria (Cephus) mandtii, Bonaparte, Tabl. Comp. Pelag. Comptes Rendus, 1856, xlii, p. 774.

Asiatic and American coasts of the North Pacific, Kamtschatka (Mus. Acad. Philada.), Russian America, Washington Territory, California (Mus. Smiths. Inst.) Breeds on the islands off the coast of California.

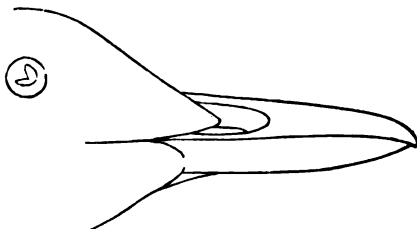


Fig. 14.—*Uria columba*.—Nat. size.

Bill stouter than that of *grylle*, more obtuse at the tip; upper mandible with the culmen straight, or even just appreciably convex, suddenly deflected; rictus straight, ascending to near the tip; gonyx and outline of inferior mandibular rami straight.

Adult.—Entirely fuliginous or plumbeous black, with a shade of invisible green. White

[Jan.

mirror on wing coverts. Nearly divided in two by a broad rather curved oblique line of blackish. No white on under wing coverts, these being grayish-brown. Bill and claws black. Mouth and feet vermillion red, tinged with carmine. "Iris white" (label).

Length 13.00; extent 23.00; wing 7.00; tail 2.20; tarsus 1.25; middle toe and claw 1.90, outer do. the same, inner do. 1.45; bill along culmen 1.20, along rectus 1.80, along gonys .65; depth at base .40; width .30.

This species closely resembles *U. grylle*; but differs in being upon an average larger, the wing particularly longer; the bill stouter, straighter, more obtuse at the point; and the marking of the wings different, as above described. The changes of plumage and the individual variations, as exhibited in the large series of specimens examined, and entirely parallel with those of *Uria grylle*.

It is worthy of note that this species occurs, in summer, upon the Pacific coast of America, much south of the corresponding latitudes on the Atlantic coasts frequented at this season by *U. grylle*.

One of the earliest indications, if not the first, of this species, may be recognized in the variety of the Black Guillemot from Kamtschatka, described by Pennant. This is said to have a white oblique line issuing from the white spot on the wing. The var. B of *grylle* of Latham and Donndorff is the same bird. Pallas appears to be the first to bestow a specific name. The question involved in the *Uria Mandtii*, Licht., has already been considered in the preceding article.

URIA CARBO, (Pall.) Brandt.

Cepphus carbo, Pallas, Zoog. R.-A. ii, 1811, p. 350, pl. 79. "*C. tridactylus, totus niger, orbites albis*," etc.

Uria (Grylle) carbo, Brandt, Bull. Acad. St. Petersb. ii, 1837, p. 346. "*Tota nigra, pedibus rubris, orbita et stria ab orbites pone oculos ducta albis*."

Uria (Cepphus) carbo, Bonaparte, Comptes Rendus, 1856, xlii, p. 774.

Uria carbo, Gray, Genera Birds, 1849, p. 644. Cassin, Baird's B. N. A. 1858, p. 913, pl. 97. Quotes Reich. Vollst. Naturg. Aves., pl. 375, fig. 2937. Cassin, Pr. A. N. S. Philada. 1862, p. 323 (Japan).

Alca carbo, Schlegel, Urinatores Mus. Pays-Bas, livr. ix, 1867, p. 17.

"In oceano orientale circa insulas Aleuticas, præsertim Unalaschka" (Pallas), Kamtschatka (Mus. Acad. Philada.), Japan (Mus. Smiths. Inst.)

Sp. Ch.—Larger than *grylle* and *columba*; the bill especially larger, stouter and straighter. Feathers of nasal fossæ and those around base of lower mandible whitish. A conspicuous white area around eyes, and extending an inch or so behind them. No white on either surface of wings. Rest of plumage brownish-black, becoming ashy black on the under parts; perhaps deep plumbeous black,

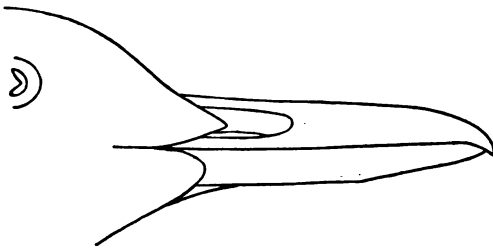


Fig. 15.—*Uria carbo*.—Nat. size.

with a shade of greenish, in more mature specimens than those examined. Bill black. Legs and feet chrome yellow, tinged with vermillion, webs coral red in the dried state; probably vermillion or carmine red in life.

Length 14 to 15 inches; wing 7.75; tail 2.50; culmen 1.55; commissure 2.20; from feathers on side of lower mandible to tip 1.50, tarsus 1.36; middle toe and claw 2.10, outer 2.00, inner 1.60.

1868.]

Another specimen: culmen 1.70; commissure 2.10; feathers on side of lower mandible to its tip 1.55; depth of bill at base .50; width at same point .38.

An interesting species of *Uria*, easily recognized by its peculiar colors, which are different from those of either of the other two species here described. Although unmistakably characterized by Pallas, in 1811, as above cited, it seems to have been overlooked by many subsequent writers. It appears, however, in the monograph by Prof. Brandt, who was well acquainted with Pallas' labors and discoveries; and is on different occasions noticed by Mr. Cassin, who has given a figure of it in the Atlas accompanying Prof. Baird's Birds of North America. There is a fine specimen in the Philadelphia Academy, from Kamtschatka; and a mutilated one in the Smithsonian Institution, from Japan. The latter is interesting on account of the new and unusual locality. The bird is chiefly an inhabitant of the higher latitudes on the coasts of the Pacific Ocean. It has not yet become a common bird in collections.

The species is somewhat larger than *grylle* or *columba*, but chiefly noticeable, as far as form is concerned, by the greater stoutness and straightness of the bill, very observable upon direct comparison. The culmen and commissure are nearly straight almost to the very tip, where they are rather suddenly decurved. The gonys and mandibular rami are quite straight; the eminence at their symphysis is well-marked. The nasal fossa is short, but wide and deep; the feathers reach to the nostrils, but do not cover them. These nasal feathers, as well as those around the base of the lower mandible, are dull white. The eyes are conspicuously encircled with white, which stretches behind them for about an inch, tapering to a fine point. There are no indications of white on the wings. With the exceptions just mentioned the whole plumage is sooty-black, tinged with slaty above, with brownish below, and becoming light ashy on the under surfaces of the wings. The bill is black, as in the other species; the inside of the mouth probably carmine red in life. The feet are light yellow in the dried specimens, doubtless vermillion or carmine red in life. The webs are still tinged with this color. The claws are black.

It is possible that the plumage just described is not that of the perfectly adult bird, in which, when fully mature, the white about the sides of the head and base of the bill may not be exactly as here described; and the body colors may be purer and more intense. Dr. Schlegel describes a specimen from the Kurile islands as "d'un noir enfumé uniforme;" and another, from Sachalin island, as an "individu au plumage imparfait; d'un brun fuligineux, passant au blanchâtre sur la face et les côtés de la tête."

LOMVIA, (Ray) Brandt.

- Lomvia*, Ray, Syn. Meth. Av., p. 120. Type *L. Hoieri* Ray, (fide Bryant).
Lomvia, Brandt, Bull. Acad. St. Pet. ii, 1837, p. 345. Type *Colymbus troille* Linn.
Cataractes, Moehring, Gen. Av. 1752, p. 68, No. 75. Based on *Lomvia* *Ins. Farræ Hoieri*.
Cataractes, Bryant, Monog. Gen. Cataractes, Pr. Bost. Soc. Nat. Hist. 1861. Type *Colymbus troille* Linn.
Alca, Linnæus, Syst. Nat. i, 1758, in part; and of many older authors. Also of Schlegel (1867), in part.
Uria, Brisson, Orn. ii, 1760, p. 377, in part; and of authors generally.
Colymbus, Linnæus, Syst. Nat. i, 1766, in part; and of many older authors.
Cephus, Pallas, Zoog. R.-A. ii, 1811, p. 345, in part.

Bill shorter than the head, longer than the tarsus, straight, or slightly decurved, usually very slender, much compressed, culmen regularly decurved in its whole length, rictus moderately and very gradually decurved, gonys straight, or even slightly concave in outline, very long, nearly as long as the culmen; a groove in the side of the upper mandible near its tip; commissural edge of upper mandible greatly inflected. Nasal fossæ scarcely apparent, fully feath-

[Jan.

ered, the nostrils wholly obtected by feathers. Feathers on side of lower mandible retreating in a straight line obliquely upwards and backwards from interramal space to rictus. Wings moderately long; tail exceedingly short, the latter contained about three and two-thirds times in the length of the former from carpus to end of longest primary; tail much rounded. Tarsus much compressed, posteriorly and laterally reticulate, anteriorly scutellate, much shorter than the middle toe and claw. Outer and middle toes about equal in length; the claw of the latter much larger than that of the former; tip of inner claw reaching base of middle one. Claws compressed, moderately arched, acute, the outer one not grooved on its outer face, the middle one greatly dilated along its inner edge. A furrow in the plumage behind the eyes.

The genus as here constituted is restricted so as to comprehend only *troile* and the species intimately related. It differs from *Uria* proper in several points, some of them of decided importance. For the benefit of those who may be sceptical regarding the propriety of separating the two forms as genera, their distinctive characters are here antithetically tabulated:

| <i>URIA (grylle).</i> | <i>LOMVIA (troile).</i> |
|---|---|
| Bill about equal to the tarsus; moderately compressed. | Bill much longer than the tarsus; much compressed. |
| Rictus straight, except just at tip. | Rictus decurved for great part of its length. |
| Gonys straight, half as long as culmen. | Gonys concave, nearly as long as culmen. |
| Upper mandible not grooved. | Upper mandible grooved near the tip. |
| Tomial edges of upper mandible scarcely inflected. | Tomial edges of upper mandible much inflected. |
| Nasal fossæ wide, deep, mostly naked; nostrils partially covered with feathers. | Nasal fossæ narrow, shallow, feathered; nostrils covered with feathers. |
| Feathers on side of lower mandible forming a salient rounded outline. | Feathers on side of lower mandible in a straight oblique line. |
| Tail short, slightly rounded, contained 2½ times in the wing. | Tail very short, much rounded, contained 3½ times in the wing. |
| Tarsus entirely reticulate. | Tarsus anteriorly scutellate. |
| Tarsus scarcely shorter than middle toe without claw. | Tarsus much shorter than middle toe without claw. |
| Outer face of outer claw grooved. | Outer face of outer claw not grooved. |
| Size moderate; no postocular furrow in the plumage. | Size large; a postocular furrow in the plumage. |

Species—(4?).

- I. Depth of bill opposite nostrils not more than a third of the length of culmen.
 - No white on sides of head; bill slender, not dilated at base; culmen, rictus and gonys much curved..... 1. *troile*.
 - A white ring and line on sides of head; bill as in *troile* 2. *ringvia*.
 - No white on sides of head; bill stout, dilated at base; culmen, rictus and gonys nearly straight..... 3. *californica*.
- II. Depth of bill opposite nostrils more than a third of the length of culmen..... 4. *svarbag*.

LOMVIA TROILE, (Linn.) Brandt.

Lomvia Hoieri, Ray, Syn. Meth. Av., p. 120; fide Bryant.

Uria major, Ger. i, p. 549; fide Bryant.

Plautus rostro larino, Klein. Av., p. 146, No. 2; fide Bryant.

Colymbus troille, Linnæus, "Fn. Suec., ed. of 1761, No. 109." Idem, Syst. Nat. i, 1766, xii ed. p. 220; not *Uria troille*, Brunn., which is *Alca lomvia*, Linn., 1868.]

1758. Gmelin, Syst. Nat. i, pt. ii, p. 788, p. 585; quotes *lomvia* of Brünnich, No. 108. Donndorff, Beytr. Zool. ii, pt. i, 1794, p. 874; confuses the quotations of several species: *e. g.*, quotes *Uria troile*, Lath., and *Alca lomvia* of Linnæus' tenth edition.
- Uria troile*, Latham, Ind. Orn. ii, 1790, p. 796, No. 1. Retzius, Fn. Suecica, p. 149. Nilsson, Ornith. Suec. 1821, ii, p. 142. Temminck, Man. Orn. ii. 1820, p. 921. Selby, Illust. Brit. Ornith. ii, 1831, p. 420. Reinhardt, Natur. Bidrag, p. 18, No. 87. Gould, B. Eur. v, 1837, pl. 396. Fleming, Hist. Brit. Anim. p. 134. De Kay, N. Y. Zool. 1844, Birds, p. 279. Gray, Genera Birds, iii, 1849, p. 644. Naumann, Naturg. Vög. Deutsch. ix, 1847, pl. 331. Peabody, Rep. Nat. Hist. Mass. Birds, p. 399; confuses *troile* and *ringvia*. Thompson, Nat. Hist. Ireland, iii, 1851, p. 207. Macgillivray, Hist. Brit. Birds, ii, 1852, p. 318. Bryant, Pr. Bost. Soc. N. H. May, 1861, p. 74.
- Uria (Lomvia) troile*, Brandt, Bull. Acad. St. Petersb. ii, 1837, p. 345. Bonaparte, Consp. Gav. Comptes Rendus, 1856, xlii, p. 774.
- Catarractes troile*, Bryant, Monog. Genus *Cal.* in Pr. Bost. Soc. N. H. 1861, p. 6, fig. 2a. Verrill, Proc. B. S. N. H. Oct. 1862, p. 143. Idem, Proc. Essex Inst. iii, 1863, p. 160.
- Uria lomvia*, Brünnich, Orn. Bor. 1764, p. 27, No. 108; quotes *Alca lomvia*, Willoughby, t. 65. Not *Alca lomvia*, Linn., 1758. Scopoli, Bemerck. Naturg. i, 1777, p. 88, No. 108; fide Donndorff. Keyserling and Blasius, Werbelth. Europ. 1840, p. 238.
- Uria (Catarractes) lomvia*, Cassin, Baird's B. N. A. 1858, p. 913. Coues, Pr. A. N. S. Phila. Aug. 1861, p. 256. Boardman, Pr. B. S. N. H. 1862, p. 131.
- ? *Cephus lomvia*, Pallas, Zoog. R.-A. 1811, ii, p. 345; quotes *lomvia*, No. 108, of Brünnich, as ♂, and *svarbag*, No. 110, of Brünnich, as ♀; also quotes *Col. troile* of Linnæus' 12th edition. Perhaps really refers to *californicus*.
- Alca lomvia*, Schlegel, Urinatores Mus. Pays-Bas, livr. ix, 1867, p. 15. (Not of Linnæus.) Ex parte. Author considers the present and the succeeding species to be varieties of one and the same species. Describes both under same name. Quotes *Uria lomvia* et *svarbag* [lege *svarbag*] of Brünnich; *Colymbus troile* of Linnæus; and *Uria rhingvia* [lege *ringvia*] of Brünnich.
- Colymbus minor*, Gmelin, S. N. i, pt. ii, 1788, p. 585; confuses three species by describing *troile*, and quoting Brünnich's No. 110 (*svarbag*) and Brünnich's No. 111 (*ringvia*). Donndorff, Beytr. Zool. ii, pt. i, p. 873; confuses three species, by quoting Latham's var. B and Brünnich's Nos. 110, 111. Author's var. γ is true *ringvia*.
- Uria minor*, Stephens, Shaw's Gen. Zool. xii, 1824, p. 246, pl. 63; erroneously quotes *svarbag*, Brünn.

European and American coasts and islands of the North Atlantic, to or beyond 80° N. On the American coast, breeds from Nova Scotia northward. "Its most favorite breeding-places south of the Straits of Belle Isle, are the Funk Islands, off the coast of Newfoundland, Bird Rock, near the Magdalen Islands, in the Gulf of St. Lawrence, and a number of small islands, generally called Murre Rocks, between Meccatina and the Esquimaux Islands, on the north shore of the Gulf," (Bryant). In winter to the extreme southern coast of New England. Specimens in all American cabinets.

Adult, summer plumage.—Head and neck all around rich dark brown, which changes on the back of the neck into dark slaty-brown, the color of the rest of the upper parts. This hue is nearly uniform, but most of the feathers of the back and rump have usually just appreciably lighter and more grayish-brown tips. Secondaries narrowly, distinctly tipped with pure white. Exposed portion of primaries dusky blackish, the shafts of the few outermost, and the greater part of the inner webs of the whole, lighter (more grayish-brown), tending to grayish-white towards the bases. Under wing coverts mostly white, variegated with dusky along the edges of the wing, and the greater coverts mostly of this latter color. Entire under parts from the throat pure white;

[Jan.

the whole length of the sides under the wings streaked with dusky or slaty-brown. Bill black; mouth yellow; iris brown; legs and feet blackish.

Adult, winter plumage.—As before; the rich brown of the head darker in hue, and more like the rest of the upper parts; the white of the under parts extending to the bill, upon the sides of the head to or slightly above the level of the commissure, upon the side of the neck so far around as to leave only a narrow isthmus of dark color, which is somewhat interrupted by white mottling. The white shades gradually into the darker color, without a trenchant line of demarcation, and varies greatly in its precise outline. Usually a pretty well defined spur of dark color runs out backwards from the eye into the white of the sides of the occiput, the spur occupying the borders of the postocular furrow in the plumage. On the sides of the lower neck, just in advance of the wings, the dark color extends in a point further than it does higher up, showing the extent of the dark brown of the summer vesture.

Young, of the first winter, are colored precisely like the adults, but may be always distinguished by their much shorter and slenderer bills, which are in great part light colored (yellowish). The feet are also much tinged anteriorly with yellowish.

Fledgelings are brownish-dusky, the breast and abdomen white; and with a few dull whitish streaks upon the head and hind neck.

Dimensions.—*Adult.*—Length about 17·00; extent 30·00; wing 8·00; tail 2·25; tarsus 1·40; middle toe and claw 2·10; inner do. 1·70; outer do. 2·00: bill along culmen 1·75, along rictus 2·50; along gonys 1·15; depth at base ·55; width at same point ·30. Bill of young, first winter: culmen 1·50; rictus 2·25; gonys ·90; depth at base ·45; width at base ·25.

This species is well known to vary to a certain degree in size, and in the precise shape of the bill. The dimensions above given represent very nearly the average of a large suite of specimens measured. In colors, the variations, though considerable, are unimportant, consisting in the difference in shade of the colors of the upper parts, and the difference in precise outline of the dark and light colors about the head and neck, in summer as well as in winter specimens. Specimens just before the renewal of the feathers have the upper parts distinctly barred or waved with gray, owing to the fading of the tips of the old feathers; and the wing and tail feathers light dull gray. The difference in intensity of coloration depends chiefly upon season, though individual peculiarities may be observed. Very highly plumaged birds have the upper parts almost uniform in hue.

The synonymy of this species is very extensive, and somewhat intricate, though it is possible to collate it with much accuracy and certainty, provided more labor be bestowed than the importance of the matter warrants, as seems to the writer to have been the case in the present instance. In consequence of the peculiarly obvious nature of the characters which distinguish the several closely allied species from the present one, even the brief diagnoses of the most antiquated authors may be recognized and identified, in the majority of instances. But it is curious to note that the various names most in vogue for two or three species of this genus have been so frequently interchanged, and so variously applied, not only in a specific, but in a generic, sense, that they have really come at last to mean nothing more than simply Murre or Guillemot. It is absolutely necessary to refer to a writer's description, or his authorities quoted, before we can have any idea to what species he alludes under any given name;—certainly a very discouraging state of affairs, and one not placing ornithology in a very creditable light.

The present species is Linnæus' *troille*, of Fn. Suec. 1761, and S. N. 1766, and is so regarded by most writers. It is the *lomvia* of Brännich, which name is usually adopted by those writers who date Linnæus' prerogative of priority at 1766. It is *minor* of Gmelin, who to a description of this species adds the synonyms of two others. It is not *troille* of Brännich, nor *lomvia* of Linnæus.

1868.]

LOMVIA RINGVIA, (Brünn.) Brandt.

Uria ringvia, Brünnich, Orn. Bor. i, 764, p. 28, No. 111; "linea a cantho oculi exteriori per latera capitis nigrantia decurrit alba." Reinhardt, Bidrag. Naturg. p. 18. Naumann, Naturg. Vög. Deutch. xii, 1847, p. 360, pl. 332. Keyserling and Blasius, Wirbelth. Europ. 1840, p. 238. Gray, Genera Birds, 1849, iii, p. 644. Bryant, Proc. B. S. N. H. 1861, p. 7.

Uria (Lomvia) ringvia, Brandt, Bull. Acad. St. Petersb. ii, 1837, p. 345. Bonaparte, Tabl. Comp. Pelagiens, Comptes Rendus, 1856, xlii, p. 774.

Uria (Cataractes) ringvia, Cassin, Baird's B. N. A. 1858, p. 914. Two of the specimens enumerated belong to *californica*, Bryant. Description that of true *ringvia*. Boardman, Proc. B. S. N. H. Sept. 1862, p. 131.

Cataractes ringvia, Bryant, Monog. Gen. Cat. in Pr. Bost. Soc. N. H. 1861, p. 8, fig. 2. Verrill, Pr. B. S. N. H. 1862, p. 143. Id., Pr. Ess. Inst. iii, 1863, p. 160.

Uria alga, Brünnich, Orn. Bor. 1764, p. 28, No. 112. Ringviæ "simillima, exceptis reatricibus totis nigra."

Columbus langvia, "Plaff, Reise n. Isl. p. 562;" fide Bryant.

Colymbus troile, var. β , Donndorff, Beytr. Zool. ii, pt. i, 1794, p. 875; quotes Brünnich's No. 112 (*alga*), and Latham's, No. 1, var. γ (also *alga*).

Colymbus troile, var. γ , Donndorff, Beytr. Zool. ii, pt. i, 1794, p. 876. "Colymbus annulo oculorum et linea pone oculos albis." Quotes Müller, Zool. dan. Prod. p. 19, No. 152a.

Uria lachrymans, La Pylaie. "Choris, Voyages Pitt. autour du monde, 23;" fide Bryant. Yarrell, Brit. Birds, iii, p. 351. Temminck, Man. iv, p. 574. Gould, B. Eur. v, 1837, pl. 397. Macgillivray, Hist. Brit. B., ii, 1852, p. 326.

Uria leucopsis, Brehem, "Vög. iii, p. 880."

Uria leucophthalmos, Faber, Isis v. Oken, 1824, p. 146. Thompson, Nat. Hist. Ireland, iii, 1851, p. 211.

Uria troille leucophthalmus, Faber, Prod. Isl. Orn. 1822, p. 42.

Uria troille, Bonaparte, Synopsis, 1828, p. 424. Two species confused. Not *Colymbus troille* Linn., nor *Uria troille* Brünn. Audubon, Orn. Biogr. 1835, iii, p. 142, pl. 218, fig. 1; oct. ed. vii, pl. 473, fig. 1. Figure 2 represents *troile*, of which the author considers the present species to be the adult. Giraud, Birds Long Island, 1844, p. 376.

American and European coasts and islands of the North Atlantic. On the American coast, breeds in the Gulf of St. Lawrence; in winter ranges south to the southern extremity of New England. Habitat the same as that of *troille*, with which it is usually found in intimate association. Spec. in Mus. Acad. Philada., Mus. Smiths. Inst., Cab. G. N. Lawrence.

Absolutely identical with *L. troille*, except in having a white ring around, and white line behind, the eye. The white ring occupies the margins of both eyelids, forming a perfect circle, posteriorly continuous with the white line which occupies the furrow in the plumage, and is an inch or more long.

The changes of plumage of this species, and the individual differences to which it is subject, are absolutely identical with those of *L. troille*. The white ring and line are usually, if not always, present in winter specimens.

The white ring and line are said to be sometimes wanting. But specimens without this character cannot be distinguished from *L. troille*.

None of the specimens contained in American museums offer any grounds for contradiction of the preceding statements.

Such being the facts in the case, each one must be allowed to determine for himself the relationship of *L. ringvia* to *L. troille*, according to the notion he may entertain of species. In forming an opinion, the facts must be borne in mind that the two kinds of Guillemots are always found intimately associated, and that they are known to copulate with each other.

It is probable that the peculiar character upon which the species rests is an individual peculiarity, not a specific difference.

This bird appears to have been first described and named by Brünnich under the designation *ringvia*. *Alga* of this author is the same bird without white

[Jan.

tips to the secondaries. Subsequently several names have been proposed, as will be seen by the synonymy adduced; each based upon the head-markings. The bird has also frequently been described as *troile*, var.

LOMVIA CALIFORNICA, (Bryant,) Coues.

? *Cephus lomvia*, Pallas, Zoog. R.-A. ii, 1811, p. 345, synonym. excl.

Uria troile, Newberry, Pacific R. R. Rep. vi, pt. iv, 1857, p. 110. Not of authors. (Coast of California.)

Uria Brünnichii, Heermann, Pacific Rr. Rep. x, 1859, Route to California, Birds, p. 75; synonym. excl. Not of authors. (Farrallone Islands.)

Catarractes californicus, Bryant, Monogr. Gen. Cat. Pr. Bost. Soc. N. H., 1861, p. 11, figs. 3 and 5. (Farrallone Islands, coast of California.)

Pacific coast of North America. Farrallone Islands, coast of California; breeding; (Mus. Smiths. Inst. and Cab. H. Bryant; the types of the species :) Sitka, Russian America; wintering; Mus. Smiths. Inst.)

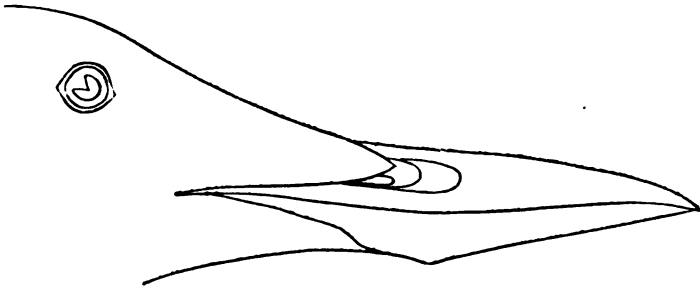


Fig. 16.—*Lomvia californica*, (Bry.) Nat. size.

(No. 17404, Mus. Smiths. A type of the species.) Entirely like *troile*, except in the form of the bill. Bill somewhat longer than that of *troile*, on an average; deeper at the base, less decurved towards the tip, the several outlines straighter. Culmen straight to near the tip, then moderately deflexed; rictus almost perfectly straight in its entire length, the commissural edge of the upper mandible toward its base somewhat expanded and everted, as in *svarbag*, though not to the same degree; the feathers on the side of the upper mandible not covering the tomial edge until very near the angula oris; gonys perfectly straight and very long, with a corresponding shortness of the mandibular rami; the angle at symphysis prominent, acute. "Iris white," (collector's label.) Length 16.00; extent 27.00, (label;) wing 8.00; tail 2.25; tarsus 1.40, middle toe and claw 2.25, outer do. 2.10, inner do. 1.70; bill along culmen 1.90, along rictus 2.90, along gonys 1.30; its depth at angle of gonys .60, its width opposite base of nostrils .35.

Winter plumage.—(No. 46522, Mus. Smiths. Sitka, Nov. 1866.) In this specimen the bill is shorter (1.75 along culmen) than in the type above described, and the culmen and rictus are more decurved. The peculiar shape, however, is still preserved, the lower mandible being deep and very prominent at the eminentia symphysis. The bird is probably one of the first winter. The plumage is entirely parallel with that of *troile* at the corresponding season. The upper parts are fully as dark as in the average of winter specimens of the latter species. The white of the under parts extends to the bill, and along the edge of the under mandible and eyes. Further back it invades the sides of the occiput and nape, where it is separated from the white of the throat by a prominent well defined spur of dark color protruding from the eye.

1868.]

As stated by Dr. Bryant, the dark parts of this species are rather paler in tint than the average of those of *troile*. But this is not a diagnostic feature, for it does not hold good in perhaps even a majority of instances. The iris, according to the label, is white; but Dr. Bryant remarks that he can hardly credit this; though if constant it would be a strong character. The only reliable diagnostic features are found in the shape of the bill, as just described. In spite of the moderate amount of individual variation to which the bill is subject, it always preserves its peculiar shape, which is sufficiently different from that of *troile* to attract attention without direct comparison of specimens. One feature which appears to have escaped Dr. Bryant's attention lies in the inflation and eversion of the basal portion of the tomia of the upper mandible, and their comparatively scanty feathering. This is an approach towards the peculiar character of *svarbag*, though by no means attaining such development as in that species. It is readily appreciable in amount in the majority of specimens.

It is worthy of note, that the peculiarities of bill which characterize this species as compared with *troile*, are very much the same as those found in the bill of *U. columba*, as compared with *U. grylle*.

It is also to be observed, that the *ringvia* style of Murre has not been found on the Pacific coast. Should the probability of its non-occurrence become a certainty, the obvious inference would be additional evidence in favor of the specific distinction of *californica*.

Numerous examples of this species are in the Smithsonian Museum, among them Dr. Bryant's types. The bird breeds much further south than its Atlantic representative, occurring in summer on the coast of California.

Among the specimens enumerated in the "Birds of North America" by Mr. Cassin, under head of *Uria ringvia*, are two examples of this species, from California. It is possible that this species rather than *troile* is alluded to by Pallas under the name of *Cepphus lomvia*.

The figure is not a very good representation, the culmen and gonyx not being straight enough. The under mandible, however, is well delineated.

LOMVIA SVARBAG, (*Brunn.*) *Coues*.

Alca lomvia, Linnæus, Syst. Nat. Ed. x, 1758, p. 130, No. 4. "Rostro lævi oblongo, mandibula superiore margine flavescente."

Uria lomvia, Bryant, Proc. Bost. Soc. N. H., May, 1861, p. 75. Not of authors, which is generally applied to *troille* Linn.

Cataractes lomvia, Bryant, Mon. Gen. Cat. in Pr. B. S. N. H. 1861, p. 9, figs. 1 and 4. Verrill, Proc. Essex Inst. iii, 1863, p. 160.

Uria troille, Brännich, Orn. Bor. 1764, p. 27, No. 109. "Rostro latiore et brevior, cujus margines, etiam in exsiccatis exuviis, flavescent." Not *Colymbus troille* Linn.

Uria svarbag, Brännich, Orn. Bor. 1764, p. 27, No. 110. Winter plumage.

Cepphus arra, Pallas, Zoog. R.-A. ii, 1811, p. 347.

Uria arra, Keyserling and Blasius, Wirb. Europ. 1840, p. 237. Cassin, Pr. A. N. S. Phila. 1862, p. 324. (Northwest coast of America.) Naumann, Naturg. Vög. Deutsch. xii, 1847, p. 536, pl. 333.

Uria (Lomvia) arra, Bonaparte, Tabl. Comp. Pelag. Comptes Rendus, 1856, xlii, p. 774.

Uria (Cataractes) arra, Cassin, Baird's B. N. A., 1858, p. 914.

Ula arra, Schlegel, Urinatores Mus. Pays-Bas, livr. ix, 1867, p. 16.

Uria Brännichii, Sabine, Trans. Linn. Soc. xii, 1818, p. 538. Temminck, Man. Orn. 1820, ii, p. 924. Bonaparte, Synopsis, 1828, p. 424. Nuttall, Man. Orn. ii, p. 529. Temminck, Man. Orn. ii, p. 576; p. 924. Reinhardt, Natur. Bidrag. p. 18, No. 88. Yarrell, Brit. Birds, p. 348. Swainson and Richardson, F. B. A. 1831, ii, p. 477. Gould, Birds Europ. v, 1837, pl. 398. Audubon, Orn. Biog. iii, 1835, p. 336, pl. 345; oct. ed. vii, pl. 472. Peabody, Rep. Nat. Hist. Mass. Birds, 1840, p. 400. Gray, Gen. Birds, iii, 1849,

[Jan.

- p. 644. Thompson, Nat. Hist. Ireland, iii, 1851, p. 213. Macgillivray, Hist. Brit. Birds, ii, 1852, p. 314.
Uria (Lomvia) Brünnichii, Brandt, Bull. Acad. St. Petersb. 1837, ii, p. 345.
Uria Francisi, Leach, Trans. Linn. Soc. xii, 1818, p. 588. Stephens, Shaw's Gen. Zool. xii, 1824, p. 243, pl. 62, fig. 2. Giraud, Birds Long Island, 1844, p. 377. DeKay, New York Zoolog. Birds, 1844, p. 280. Peabody, Rep. Birds Massachusetts, p. 400.
Uria polaris, Brehm.

Coast of the North Atlantic and Pacific, and of the Arctic Seas. Herald Island, (Mus. Smiths.) In winter, on the American coast south to New Hampshire, (author's Cabinet) and New Jersey, (Mus. Acad. Philada.) Breeds in the Gulf of St. Lawrence, (Bryant.)

Form subtypical of the genus. Bill short, hardly exceeding the tarsus in length of culmen, very stout, wide and deep at the base; culmen curved in its whole length; rictus straight for about half its length, then much deflexed; gonys long, its outline decidedly concave; mandibular rami short, eminentia symphysis very prominent; tomial edges of the upper mandible in their basal half turgid, and entirely bare of feathers. Slightly larger, and rather more robustly organized than *troile*. In other respects of form identical with *troile*; the plumage and its changes also the same. The turgid portion of the tomia of the upper mandible flesh colored in life, becoming yellowish in the dried state.

Length 18.00; extent 32.00; wing 8.50; tail 2.25; tarsus 1.25, middle toe and claw 2.10; outer do. 1.90; inner do. 1.60; bill along culmen 1.40, along rictus 2.20, along gonys .90, depth at eminentia symphysis .55, width at base of nostrils .30, at angula oris .80.

The peculiar shape of the bill strongly characterizes this species. It is a rather more robust bird than *troile*, and upon an average a little larger. The colors of the plumage are not very appreciably different; perhaps slightly darker, and tending a little more decidedly towards a slaty or plumbeous hue, particularly in winter. The seasonal changes are precisely the same. The only decided difference in color lies in the whitish or yellowish hue of the expanded tomia of the upper mandible.

Brünnich's Guillemot appears to be the most boreal species of the genus, frequenting the Arctic seas, as well as more temperate latitudes. At the same time it has been found further south in winter, on the Atlantic coast of North America, than the other species; and is of frequent occurrence on the United States coast at that season. It is also of constant occurrence in the North Pacific.

This is unquestionably the *Alca lomvia* of Linnæus, 1758. The name should stand for the species, were it not now in use for the genus. It has been more usually employed for *troile*. The *troile* of Brünnich is unmistakeably this species, but is preoccupied by its Linnean application for the common species. *Svarbag*, Brünnich, comes next in order. This is based upon the winter plumage, and must stand as the specific designation of the bird. Pallas named it *Cephus arra* in 1811; and Sabine renamed it *Uria Brünnichii* in 1818. Both these names, but particularly the latter, are in very general employ at the present day. *Francisi* of Leach, 1818, also this species, has never had much of a run with writers.

List of BIRDS collected in Southern Arizona by Dr. E. Palmer; with remarks.

BY DR. ELLIOTT COUES, U. S. A.

Dr. Palmer has kindly transmitted to me a list of the birds collected by him at Camp Grant, about sixty miles east of Tucson, Arizona, during the present year. The species are identified by Prof. Baird. The collection contains four species (marked with an asterisk in the following list) not previously accre-
 1868.]

dited to the Territory. Although by no means a complete exponent of the birds of Southern Arizona, the list is valuable in clearly indicating some differences between the avifaunas of the southern desert and northern mountainous portions of the Territory. Compare the species mentioned below with those characterizing the Fort Whipple fauna, as elucidated in my "Prodrome," Pr. A. N. S. Phila. Jan. 1866.

In my "Prodrome," 245 species are enumerated; one of which (*Certhiola flaveola*) was inserted by mistake. The present collection raises the number to 248. The various species mentioned passim in my paper as of probable occurrence, will, when substantiated as inhabitants of the Territory, further increase the number to about 260.

Some manuscript notes with which Dr. Palmer has favored me are placed in quotation marks. Species known to occur throughout the Territory are in small capitals; others in italics.

CATHARTES AURA, Linn.

FALCO SPARVERIUS, Linn.

ACCIPITER COOPERI, Bonap.

"Nesting, June 1st, in crotches of cottonwood trees along river bottoms."

AQUILA CANADENSIS, Linn.

One of the southernmost localities on record for this species.

Geococcyx californianus, Less.

Chiefly southern and western Arizona. Rare or casual at Fort Whipple. "Very destructive to small animals, snakes, and hard-shelled insects."

Chordeiles texensis, Lawr.

Chiefly southern and western Arizona. Not observed at Fort Whipple, where *C. Henryi* is abundant.

Centurus uropygialis, Baird.

Chiefly southern and western Arizona. Rare or accidental at Fort Whipple.

MYIARCHUS MEXICANUS, Kaup.

"Is very fond of hovering about the giant cactus, *Cereus giganteus*, when in bloom, to catch the wasps and bees. Builds a loosely constructed, flat nest, often in dwelling-houses."

SAYORNIS SAYUS, Bon.

The egg of this species, Prof. Baird writes me, is much like that of *Empidonax Traillii*. Dr. Palmer's specimens are the first ones ever obtained. "The nest was procured May 3d, from the eaves of a house. The parent birds, when alarmed, hovered about uttering plaintive cries, and returned to renew their mournful notes for several days after the invasion of their home."

Pyrocephalus mexicanus, Sclater, P. Z. S. 1859, p. 45.

Southern and western Arizona. Has not been found as high as Fort Whipple.

Atthis Costæ, Bourc.

Chiefly southern and western; perhaps to Fort Whipple.

Trochilus Alexandri, Bourc.

I included this species in my "Prodrome" (p. 20), mainly on the strength of its occurrence in the Colorado Valley, very near the river (Mojave River, Dr. J. G. Cooper). Dr. Palmer is, I believe, the first to detect it actually within the Territorial limits. Possibly it should be in small capitals. "Nest six feet high, in a bush, in a deep ravine."

TURDUS MIGRATORIUS, Linn.

SIALIA MEXICANA, Swains.

ANTHUS LUDOVICIANUS, Licht.

[Jan.

Pyrranga ludoviciana, Wils.

Dendroeca auduboni, Towns.

D. aestiva, Gmel.

Myiodytes pusillus, Wils.

Campylorhynchus brunneicapillus, Lafres.

Chiefly southern and western Arizona. "Builds between the arms of the giant cactus, and among the branches of more arborescent ones; also in the shrub called 'palo verde' by the Mexicans" (*Fouquieria*?). "A nest taken May 15th was of an elongated shape, loosely built of straws and sticks; the foundation thick, raising the eggs to the middle of the nest. The orifice in the side of the nest was small, and partially concealed by loose out-hanging materials."

Salpinctes obsoletus, Say.

Throughout the Territory, but most abundant in its warmer portions.

**Harporhynchus curvirostris*, Cab.

My remarks (Prodrome, p. 29) upon Dr. Heermann's notice of this species are to be cancelled, as not pertinent. Dr. H.'s specimen is commented upon by Baird (B. N. A. 1858, p. 352), and referred with a query to *H. curvirostris*. Dr. Palmer's specimens add the species to the Territory. "Rare. Builds in arborescent cactuses, a few feet from the ground. The nest is upright, with loose twigs projecting all around. Two eggs were found in one."

Vireo pusillus, Coes, Prodrome, p. 40. Baird, Review, p. 360. *V. Belli*, Cooper, (nec Aud.) Pr. Cal. Acad. Nat. Sci. p. 122.

First obtained by Mr. Xantus at Cape St. Lucas; then by Dr. Cooper at San Diego, Cal.; then by the writer at Date Creek, a little south of Whipple. The present specimens further extend its range. It should perhaps be in small capitals. Dr. Palmer has obtained the eggs.

Phænopepla nitens, Swains.

"Feeds upon the berries of the parasitic plant" (*Arceuthobium*? *Phoradendron*?) "which grows on the large mezquite trees. Is extremely shy, with a quick, high flight."

Icteria longicauda, Lawr.

"Nests in thick underbrush. Feeds upon wild currants."

Auriparus flaviceps, Sundevall.

Southern and western. Not found in the mountainous districts. "Builds upon the outer limbs of bushes along shady river banks. The weight of the nest often causes the limb to hang nearly to the ground."

Carpodacus frontalis, Say.

Chrysomitris psaltria, Say.

Zonotrichia gambeli, Nuttall.

Poecetes gramineus, Gm.

Chondestes grammacus, Say.

Melospiza fallax, Baird.

Spizella breweri, Cassin.

Spizella socialis, Wils.

Poospiza bilineata, Cassin.

Perhaps to be in small capitals; but certainly most abundant in southern and western Arizona. "A nest containing three eggs was built in a dwarf mezquite bush, a few inches from the ground."

Calamospiza bicolor, Towns.

I did not find this species at Fort Whipple, and have no reason to believe 1868.]

that it occurs in northern Arizona, though it is found much further north (Kansas, Nebraska, etc.), along other meridians of longitude. But it is nevertheless common in the Gila Valley, and thence extends to the Pacific, though it does not reach the ocean in the latitudes of Upper California, Oregon and Washington. There is something peculiar in its distribution, not satisfactorily explained upon any hypothesis touching the climate or physical geography of the regions inhabited by it.

**Cardinalis igneus*, Baird, Pr. A. N. S. Philad. 1859.

Not before recorded from Arizona. This is a Cape St. Lucas species, which, as I remarked (Prodrome, p. 54), was to be expected to occur in southern Arizona, though I had at that time no authority for including it in my list. Its present acquisition is a matter of much interest.

Pyrrhuloxia sinuata, Bonap.

Confined to the southern districts.

GUIRACA MELANOCEPHALA, Swains.

"Builds a flattish nest in crotches of young willows, a few feet from the ground."

PIPILO CHLORURA, Towns.

Pipilo mesoleucus, Baird.

Chiefly southern and western Arizona, but extends very near Fort Whipple. Dr. Palmer says that it nests in much the same situations as those selected by the *Icteria longicauda*.

Pipilo Abertii, Baird.

This, and the preceding species, are nearly identical in their range, and are the characteristic species of the genus in the Gila and Colorado Valleys. Will not *P. albigula* (Baird, Pr. A. N. S. Phila. 1859; from Cape St. Lucas) be hereafter detected in south-western Arizona?

MOLOTHRUS PROORIS, Gm.

AGELÆUS ——— ?

XANTHOCEPHALUS ICTEROCEPHALUS, Bonap.

**Icterus cucullatus*, Swains.

An acquisition. Not previously detected in the United States, except in the valley of the Lower Rio Grande. *I. Bullockii* has been hitherto the only Oriole accredited to the Territory.

STURNELLA NEGLECTA, Aud.

CORVUS CARNIVORUS, Bartram.

LOPHORTYX GAMBELI, Nutt.

"In early spring the Quail feed much upon mezquite seed, and the tender shoots of a certain aromatic plant. The nest, built among underbrush along the river bottoms, is merely a small shallow depression, thinly lined with soft grass, leaves and feathers. The eggs are almost exactly like those of the California Quail." (Pale buff, or yellowish-white, blotched and spotted all over with different shades of brown; of the usual shape in this family.)

MELEAGRIS MEXICANA, Gould.

Generally distributed throughout Arizona and New Mexico; but rare in certain localities, and extremely abundant in others.

ÆGIALITIS VOCIFERUS, Linn.

FULICA AMERICANA, Gmel.

BERNICLE HUTCHINSI, Richardson.

QUERQUEDULA CYANOPTERA, Vieill.

[Jan.

**LOPHODYTES CUCULLATUS*, Gmel.

Not before recorded from the Territory, though its occurrence was to have been anticipated. (Cf. *Prodrome*, p. 63.)

PODICEPS CORNUTUS, Gmel.

Jan. 28th.

MR. CASSIN, Vice-President, in the Chair.

Thirty-one members present.

The following gentlemen were transferred from the list of members to that of correspondents: Jos. Jones, M.D.; W. F. Reynolds, U. S. Top. Eng.

Dr. Allen's resignation as Corresponding Secretary was read and accepted.

The following Committees were elected for 1868 :

Ethnology.—J. Aitken Meigs, S. S. Haldeman, F. V. Hayden.

Entomology and Crustacea.—John L. Le Conte, J. H. B. Bland, Tryon Reakirt.

Comparative Anatomy and General Zoology.—Joseph Leidy, Harrison Allen, S. B. Howell.

Ornithology.—John Cassin, Spencer F. Baird, B. A. Hoopes.

Mammalogy.—Harrison Allen, E. D. Cope, John Cassin.

Conchology.—Geo. W. Tryon, Jr., Rev. E. R. Beadle, C. F. Parker.

Herpetology and Ichthyology.—Edward D. Cope, S. Wier Mitchell, Chas. Shaeffer.

Geology.—Isaac Lea, F. V. Hayden, T. A. Conrad.

Physics.—Robt. Bridges, R. E. Rogers, Jacob Ennis.

Library.—Jos. Leidy, John Cassin, Robert Bridges.

Botany.—Elias Durand, Aubrey H. Smith, Elias Diffenbaugh.

Mineralogy.—Wm. S. Vaux, S. R. Roberts, Jos. Willcox.

Paleontology.—T. A. Conrad, Jos. Leidy, Wm. M. Gabb.

Proceedings.—Joseph Leidy, Wm. S. Vaux, John Cassin, Robt. Bridges, Geo. W. Tryon, Jr.

Prof. Edw. D. Cope was elected Corresponding Secretary.

Feb. 4th.

The President, DR. HAYS, in the Chair.

Forty-one members present.

E. D. Cope made some observations on the living inhabitants of caves in south-western Virginia. He said he had examined some fifteen, which were not generally known; one of them, Spruce Run Cave, in Giles county, for a 1868.]

distance of $2\frac{1}{2}$ miles. He said that, besides bats, the *Neotoma floridana* was very abundant, and made nests like those of birds. He also found some articulates peculiar to them. The few molluscs were the same as those of the woods, and did not occur far from the mouth. The only beetle was entirely blind, being a new *Anophthalmus*, *A. pusio* of Horn, and was rare. A species of fly, apparently identical with one usually found about excrements, was found in all the localities where rats occurred. There were two species of Myriapoda, one the *Cambala annulata* Say, quite rare and with rudimentary eyes, and the other, most common in the remote recesses only, the *Pseudotremia cavernarum* Cope, sp. nov. (gen. nov.) of the *Lysopetalidæ*, with eyes better developed.

Special Meeting, Feb. 6th.

MR. VAUX, Vice-President, in the Chair.

Twelve members present.

Dr. Ruschenberger announced the death of Mr. Jacob Gilliams, one of the founders of the Academy, on the 4th inst., in the 86th year of his age.

On motion, the meeting adjourned to attend the funeral.

Feb. 11th.

The President, DR. HAYS, in the Chair.

Thirty members present.

The following paper was presented for publication :

"Description of some new species of diurnal Lepidoptera. Series III." By Tryon Reakirt.

Mr. Vaux, on behalf of Dr. Ruschenberger, offered the following resolutions, which were adopted :

Resolved, That in the death of Mr. Jacob Gilliams, at an advanced age, the Academy has lost the latest survivor of its seven founders and one of its oldest friends.

That the society holds in grateful remembrance his efforts to encourage the cultivation of the natural sciences at a period when they attracted the attention of few persons in Philadelphia.

That to his interest in natural history the foundation of this institution may be in a great measure justly attributed.

That the friends of the natural sciences recognize in his early labors to establish an institution devoted to the collection of materials and the publication of essays for the purpose of diffusing knowledge of the natural history of the world, a claim to their lasting respect.

That the Academy tenders to the members of his family this expression of sympathy in their bereavement; and that the President of the Academy is requested to communicate to them a copy of these resolutions suitably engrossed.

Feb. 18th.

MR. CASSIN, Vice-President, in the Chair.

Thirty-four members present.

[Feb.

Feb. 25th.

The President, DR. HAYS, in the Chair.

Twenty-six members present.

The deaths of the following gentlemen were announced: Marcel de Serres, Tobias Wagner, and Gen. Geo. A. McCall.

The following gentlemen were elected members: Stephen Morris, Thos. T. Tasker, Jr., Stephen P. M. Tasker, Henry G. Morris, Jas. E. Caldwell and C. Newlin Peirce.

On favorable report of the Committee, the following paper was ordered to be published:

Descriptions of some new species of Diurnal LEPIDOPTERA.

SERIES III.

BY TRYON REAKIRT.

51. *LYCÆNA MARINA*, nov. sp.

Male. Upper surface lustrous violet blue, edged with a narrow black line; usually towards the anal angle there are two rounded black spots; these are, however, sometimes obsolete; fringe white; expanse .8—1 inch.

Underneath soiled white; fore wings' costa, brown; from the base, five transverse bands extend across the wing from the costa to the inner margin; the fourth and fifth are sometimes interrupted on the second median veinlet; a sixth runs down from the costa to the same nervule, and a seventh and narrower one reaches only the third nervule; following these there is a submarginal row of connected lunulæ, enclosing oblong darker brown dashes between themselves and the margin.

Upper half of secondaries traversed by numerous brown lines, commonly six in number, always interrupted in different points, and dilated and compressed irregularly; then there is a soiled white submesial band; and then the series of lunulæ, dashes and spots as on the fore wings, rarely confluent; the two spots nearest the anal angle are jet black, irrorated with shining green atoms; and ringed with ochreous-yellow.

Body black above, clothed with bluish hairs, whitish beneath; antennæ black with whitish annulations.

Female. Upper surface white, glossed with violet blue at the base; costa of both wings and outer margin of the primaries broadly brown; the white area of the fore-wings is traversed by three maculate brown belts; one sub-basal, the second mesial, the third subapical and merging into the brown border.

Across the disc of the secondaries are several brown rays, and a submarginal lunulate brown line encloses a marginal series of large rounded brown spots, of which the second from the anal angle is always the largest and deep brown or black.

Underneath marked as in the *male*, but with much less intensity; the lower portions of the transverse bands of the fore wings are frequently obsolete; on both wings they are narrower and less compact, thus increasing the white spaces; the submarginal lunulæ and spots, as in the males, wanting sometimes the ochreous yellow rings. Expanse .87—1.05 inches.

Hab.—Orizaba, Mexico. (Coll. Tryon Reakirt.)

"Mexico, near Vera Cruz." Wm. H. Edwards.

Allied to *Lycæna Cassius*, Cram.

52. *GONILOBA DOLORES*, nov. sp.

Upper surface clear brown, with olive brown hairs below the median nervure of the primaries towards the base, and over the basal half of the secondaries.

daries. Four translucent ochreous spots on the primaries; the first large and near the end of the cell, is of trapezoidal form, with an angular indentation upon the outer side; the second, also trapezoidal, but less than the preceding, is contained within the second and third median veinlets, and situated midway between the first and the outer margin; the third, resembling an irregular right-angled triangle, is aligned on the first median veinlet, with the second and fourth, which last is small and obovate, placed on the submedian vein just beyond its middle; a curved ash-gray bar, widest centrally, and tapering at either end, extends between these last spots and the cell from the submedian vein to the second median veinlet, touching above the upper angle of the third spot, and below the inner portion of the ovoid.

Secondaries immaculate; fringe ochreous yellow, lightly cut with brown; expanse 2.13 inches.

Underneath, the primaries have an ash brown apical triangular patch, separated by a brown bar from an irregular purplish-ashy belt, extending from the margin down to the second translucent spot, and which contains a darker spot near the middle of its inner margin; the costa between this belt, and a pale ochreous spot resting thereon, above the translucent spot in the cell, is reddish brown; the fourth spot of the upper surface is covered by a large pale yellow ovoidal spot; the ashy bar is wanting.

Secondaries pale purplish brown, with darker velvet maroon brown shades, formed into three prominent areas, viz., a broad border, a large central patch, and another resting on and below the middle of the costa; there are also two basal bars and a series of connected lunulæ between the central patch and the marginal band. Antennæ brown; club ochreous beneath.

Hab.—"Mexico, near Vera Cruz." Wm. H. Edwards.

53. *Pyrgus Georgina*, nov. sp.

Upper surface black, with ashy shades, and waved brown lines traversing the surface. Primaries: a white spot occupies the middle of the cell; beyond a mesial white band, broken into two parts, of which the lower occupies the central portion of the first median interspace; the upper extends from beyond this to the costa; on the margin, midway between this band and the apex are two small white spots; there is an indistinct series of submarginal black spots, each having a minute whitish or gray point, sometimes enlarging into an enclosing crescent, attached to its outer extremity.

Secondaries: a broad mesial band, bifid on the costa; below, a sinuated irregular line; both white; a submarginal series of indistinct spots. Fringe brown, white towards the anal angle; expanse 1.25—1.5 inches.

Below, primaries; an oblong white dash in the cell; the central band as above; an abbreviated series of three or four white spots run down from the costa, in place of the two on the upper surface; along the outer margin a series of large white oblong dashes, becoming brownish towards the apex, and containing each a rounded dark brown spot—in the lowest, the spot is geminate.

Secondaries white, or soiled white, more or less brown towards the base; a subcentral maculate row of brown spots, of which three or four are contiguous, towards the abdominal margin, and two distinct ones nearer the costa; along the outer margin are connected lunulæ, rarely coalescing with the spots of the inner row.

Body above black; the rings of the abdomen marked with whitish hairs, underneath white; palpi white, excepting the terminal article, which is black. Antennæ brown, with incomplete white annulations, club tipped with ferruginous.

Hab.—"Mexico, near Vera Cruz." Wm. H. Edwards.

Dedicated to my cousin, Mr. Geo. W. Tryon, Jr., the distinguished Conchologist, as a slight acknowledgement of his unvarying kind assistance in my studies.

[Feb.

54. *CIRROCHROA TYCHE*, Felder.

♂ Felder, Wiener, Entom. Monatschr. v. p. 301, n. 13, (1861.)

Female. Upper surface ochreous brown; a broad pale belt crosses the outer half of the forewings, bordered interiorly by a gradually diminishing waved dark brown bar, broadest below the subcostal vein, and becoming obsolete towards the inner margin; the outer margin is dark brown, interior to which are two angulated transverse lines, the outer being brownish black and complete, the inner brownish ochreous, and obsolete in its lower portion; three indistinct brownish spots arise from the inner margin in the pale belt, decreasing in size upward.

On the secondaries the transverse belt is suffused with the ochreous ground color, and contains six rounded or oval black spots—there being none in the discoidal interspace; the anterior narrow black line, and the posterior lunulate or angulated lines,—three of these on the hind wings,—are all complete, extending from the costal to the abdominal margin, and anal angle.

Underneath pale ochreous, the markings of the upper surface repeated in pale shades; the outer half of the wing glossed with lilacine; a continuous lilaceous band underneath the mesial brown line. Expanse 2.75 inches.

Antennæ black, bright ferruginous underneath, and upon the club.

Hab.—Mindoro. (*Dr. Chas. Semper.*) (Coll. Tryon Reakirt.)

I am indebted for this beautiful species, along with many other rarities, to Mr. Georg Semper, brother of the celebrated collector.

55. *PAPILIO BURTONI*, nov. sp.

Size and shape of *Pap. Leucaspis*, Godt.

Male. Upper surface pale greenish yellow; a very broad, dark brown terminal band along the outer margin of both wings; along the interior edge of which band, on the fore wings, is a darker brown stripe, extending from the cell to the inner margin; two wide dark brown belts traverse the fore wings, both merging into the terminal border—one resting over the end of the cell, cuts off a small lunulate piece of the ground color, the other is a mesial band, running from the middle of the costa towards the inner angle.

Upon the border of the hind wings are several pair of imperfect lunes, composed of lustrous bluish gray atoms; above the anal angle a yellow lune, and above this a red lune, sometimes two of these; the brown border is continued some distance along the abdominal margin. The long slender tail terminates with a large yellowish white patch.

Underneath mainly as above; the outer border of both wings is irrorated with lilacine atoms, assuming the form of lunulæ upon the lower portion of the hind wings. Expanse 4 inches.

Head, throat and abdomen, dark brown.

Antennæ black, with bright orange brown clubs.

Hab.—Insagassugá, New Granada. (Coll. Tryon Reakirt.)

This magnificent species was one of a large collection formed by Hon. A. A. Burton, near Bogotá, and has most appropriately been dedicated to him.

56. *DIRENNA BAIRDII*, nov. sp.

Allied to *Dir. Jemima*, Hübn. Wings translucent, ochrey-yellowish, with darker semi-opaque spots and border.

Male. The fore wings are narrower and more acute than in the related species; the disposition of the pellucid spots upon these is similar to *Jemima*; their hind margin, however, is black instead of orange-ochreous; the median vein is orange to the end of the cell; all the others black.

Hind wings; the black terminal border does not extend so far upon the abdominal margin, upon which there is an orange brown patch, and is more diffused inwardly; the basal half of the wing is ochreous, as are also the veins contained therein; those upon the outer half, which is covered with the black shade, are black.

Underneath as above, with the addition of three apical silvery white spots 1868.]

upon the fore wings; a costal streak, three oblong apical spots, and three triangular spots along the outer margin of the hind wings, all silvery white. Expanse 2.75 inches.

Head, thorax and abdomen, above blackish brown, below the thorax is spotted with white, but no yellow stripes as are in *Jemima*; abdomen below yellowish. Antennæ blackish at base, orange brown beyond, darkening towards the apex.

The female does not differ from the male, save in the more rounded wings, and in intensity of coloration.

Hab.—Insagasugá, New Granada. (Coll. Tryon Reakirt.)

57. *MECHANITIS FRANIS*, nov. sp.

Very closely allied to *Mech. Menapis*, Hewits.

Differs chiefly in the larger size of the fulvous basal area of the fore wings; in the invariable presence of a large rounded black spot, between the first and second median veins; and in the more common division of the black portion of the hind wings into a central belt, and a terminal border.

Underneath as in *Menapis*, with the above differences.

Hab.—Insagasugá, New Granada. (Coll. Tryon Reakirt.)

I can hardly believe this to be a local variety of *Menapis*; both were captured at the same place, and time, and throughout a long series of specimens I find the differences to remain constant.

58. *PYRROPHYGA BOGOTANA*, nov. sp.

Upper surface black, brilliantly glossed with steel blue; the posterior two-thirds of the outer margin of the hind wings, is bordered with bright orange brown, broadest towards the anal angle, gradually diminishing to the other extreme point, and scalloped interiorly.

Underneath the same, with perhaps less shining reflections.

Body and legs glossy blue-black, with orange-brown palpi. Antennæ black.

Expanse 2.25 inches.

Hab.—Insagasugá, New Grenada. (Coll. Tryon Reakirt.)

59. *PYROUS ALANA*, nov. sp.

Upper surface white, faintly tinged with yellowish; costa of primaries, and a large apical patch, covering the outer two-fifths of the wing, dark brown; the latter, which is concaved interiorly, and traversed by darker brown veins, presents a transverse, indistinct, white macular, narrow subapical band, frequently entirely obsolete.

Secondaries with an irregular narrow brown border, from which brown veins rise a short distance into the area of the wing.

Fringe of primaries brown; of secondaries, first narrowly white, bordered externally with brown, forming two parallel lines around the whole outer margins.

Underneath chiefly as above, with the brown more diluted, and the white subapical band of the primaries, and the whole white surface of the secondaries, replaced with ochreous yellow; the former consists of six distinct spots, of which the two lower are the largest, and extend to the outer margin; the white basal area of the fore wings is more or less tinged with yellow.

On the secondaries, the veins are all lined with black, and there are two diffused brown patches; one below the centre of the wing and towards the abdominal margin, the other on the outer edge near its middle.

Expanse 1.70 inches.

Thorax and abdomen above black, clothed with whitish hairs; the latter, below, yellow, with a double brown stripe; head palpi, and antennæ brown; a yellow collar above the first.

Hab.—Insagasugá, New Granada. (Coll. Tryon Reakirt.)

[Feb.

60. *HELICONIUS GUARICA*, nov. sp.

Upper surface dark brown, glossed with bluish black; anterior wings crossed by a broad central transverse scarlet band, abruptly terminating after the first median veinlet, and not touching the outer margin; posterior, immaculate.

Underneath, the band becomes pale rosy white, edged only with dark pink; the costa of forewings, presents a short basal scarlet bar, that of the hind wings a longer yellow one; upon these are also five basal spots, one yellow, surrounded by four scarlet ones.

Body black, with some yellow stripes on thorax below and a yellow ventral stripe; some yellow spots on the collar; first and second joints of palpi yellow; third black. Antennæ black.

Expanse 2.65 inches.

Hab.—Insagásugá, New Granada. (Coll. Tryon Reakirt.)

Closely allied to *H-l. Hydara*, Hewits, but constantly differs in the absence of a scarlet spot on the upper side of the secondaries.

In the same number (63) of his "Exotic Butterflies," he has redescribed *Callidryas Thauruma*, Reakirt, as *Call. Fiaduna*; his name must therefore be regarded as a synonym.

March 3d.

MR. VAUX, Vice-President, in the Chair.

Twenty-three members present.

March 10th.

The President, DR. HAYS, in the Chair.

Forty members present.

The following papers were presented for publication:

"A new species of *Osmerus*." By Thaddeus Norris.

"Description of nine new species of Unionidæ, from Lake Nicaragua, C. A." By Isaac Lea.

"An examination of the Reptilia and Batrachia obtained by the Williams College Expedition to Equador and the Upper Amazon, with notes on other species." By Edw. D. Cope.

A letter was read announcing the death of Sir David Brewster.

The Publication Committee announced the issue of No. 4 of the Proceedings for 1867.

March 17th.

The President, DR. HAYS, in the Chair.

Thirty-three members present.

Mr. Benj. Smith Lyman made the following remarks on a bent marble stone presented by Mr. Edward Shippen to the Academy.

The bent gravestone of Dr. William Shippen, who died 11th July, 1808, and of Alice his wife, who died 25th of March, 1817, was formerly in the 1868.]

burial ground on Arch street, above 5th. As it had to be removed on the closing up of that ground, it was thought best to replace it by a new one, and the bent stone was given to the Academy on the 15th of November, 1867. The stone is of white Pennsylvania marble and is 6 ft. 3½ in. long, by 3 ft. 1 in. wide and 2 in thick. It simply rested on six marble posts, without being fastened to them, except imperfectly by mortar, and must have bent merely from its own weight. The posts stood on separate brick foundations under ground, but the near (northern) middle post of the picture had sunk so as no longer to touch the slab, and the other middle post had settled also. The space between the inner sides of the end posts, lengthwise of the slab, was 4 ft. 9¼ in. The stone is bent down in the middle an inch and a half from a straight line drawn from the near right hand corner to the far left hand corner (northwest and east) and half an inch from the line drawn cornerwise the other way; and lengthwise through the middle it is bent an inch and a sixteenth from straightness.

March 24th, 1868.

The President, DR. HAYS, in the Chair.

Forty-two members present.

The following was presented for publication :

"Sexual Law in *Acer dasycarpum*." By Thos. Meehan.

Prof. Cope exhibited to the Academy several fragments of a large Enaliosaurian, discovered by the Academy's correspondent at Fort Wallace, Kansas, Dr. Theoph. H. Turner. Portions of two vertebræ brought east by Dr. Le Conte from his geological survey of the Pacific Railroad route, had previously indicated to the speaker the existence of an animal related to the *Plesiosaurus*, and the recovery of the greater part of the reptile had confirmed this affinity.

The remains consisted of over one hundred vertebræ, with numerous portions of ribs, the greater part of the pelvic and scapular arches, with two long bones somewhat like femora. Part of a muzzle, with teeth, belonged to the same animal.

The species represented a genus differing in important features from *Plesiosaurus* and its near allies. These were the absence of diapophyses on the caudal vertebræ, and the presence of inferiorly directed plate-like parapophyses, which took the place of the usual chevron bones, in the same position; also in the presence of chevron-like bones on the inferior surfaces of the cervical vertebræ; further in some details of the scapular and pelvic arches. The diapophyses of the dorsal vertebræ originated from the centrum, and not from the neural arch.

In generic features it was related to the *Cimoliasaurus* and *Brimosaurus* of Leidy, so far as the latter are yet known. It differed from both of them in lacking diapophyses on the lumbar vertebræ.

The general form was different from *Plesiosaurus* in the enormous length of the tail, and the relatively shorter cervical region. The total length of the vertebral column sent was thirty-one feet ten inches, divided as follows: caudals 18 ft. 10 in., dorsals 9 ft. 8 in., cervicals 3 ft. 4 in.; adding for missing cervicals and cranium at least 2 ft. 6 in., we have a total of 34½ feet. An interval of three to four feet occurred between the cervicals and dorsals as they lay in the cliff from which they were excavated, which if, as is probable, it was occupied by vertebræ in the animal, would give a length of thirty-eight feet. The caudal vertebræ had very compressed centra, and elevated neural and hæmal laminae, and were of unusually elongate form. Neural arches everywhere on the column co-ossified. All the vertebræ considerably more constricted me-

[March,

dially than in *Brimosaurus* or *Cimoliasaurus*, and none except cervicals with such small antero-posterior diameter as the latter possess.

The general characters of the species would be presented in a special essay.

He called it *ELASMOSAURUS PLATYURUS* Cope, from the caudal laminae, and the great plate bones of the sternal and pelvic regions. It was a marine saurian, whose progression was more largely accomplished by its tail than by its paddles.

The teeth and muzzle showed it to be an ally of *Plesiosaurus*. The former were cylindric, implanted in very deep alveolæ, and furnished with a very small pulp cavity. The exposed surface closely and sharply striate to the narrowly acuminate tip.

The beds were argillaceous, with much gypsum; the latter mineral coating the bones. The age was cretaceous; perhaps, according to Le Conte, the upper middle. The matrix beneath the dorsal vertebræ contained remains of perhaps six species of fishes, several ctenoid, among them a known *Enchodus*, and a *Sphyræa*, to be called *Sph. carinata* Cope.

The complete and mounted skeleton of the fossil Irish Elk, now in the Museum, was presented to the Academy by Mr. J. A. Wright.

On motion the Academy tendered to Mr. Wright a vote of thanks for his magnificent donation.

March 31st.

The President, DR. HAYS, in the Chair.

Thirty members present.

The deaths of Mr. Thos. Earp, and Mr. C. F. Hagedorn, were announced.

On leave being granted, the following paper was presented for publication:

"On a new mineral in Cryolite, Ivigtite." By Theo. D. Rand.

The following gentlemen were elected Members:

Dr. Thomas B. Reed and Mr. Richard Peltz.

The following were elected Correspondents:

Dr. Fred'k Stoliska, of Calcutta, Maj. Geo. Clendon, Jr., of Glenn's Falls, N. Y., and Mr. R. H. Stretch, of San Francisco, Cal.

On favorable report of the Committees, the following papers were ordered to be published:

Remarks on the New Species of *OSMERUS* (*O. Sergeanti*.)

BY THADDEUS NORRIS.

At a meeting of the Academy of Natural Sciences, March 26, 1861, the writer presented "Remarks on a new species of *Osmerus* taken in the Schuylkill below Fairmount dam," describing its specific characteristics as compared with those of the Northern Smelt, *O. viridiscens*, also, naming other rivers besides the Schuylkill in which it is found.

Although I was then well convinced of the difference between the two, those who composed the committee on Ichthyology could not admit sufficient peculiarity in this to constitute it a new species; I therefore suppressed the specific name given above, which I now renew: having no less authority than 1868.]

that of Professor Agassiz, who has examined and compared the one with the other. I would add that my conjectures as to the new species being found at the terminus of the tide in the tributaries of the Delaware river have proved correct; as I have since ascertained that it is taken in March in the Brandywine below the dam at the head of tide, as well as at the foot of the rapid water at Trenton, appearing for a short time before spawning and apparently only for that purpose.

My object in this communication is to establish this as a distinct fish and give it a specific appellation, as well as to settle any question of priority of description which may hereafter arise.

I have presented this evening a small vial which holds the contents of the stomach of a northern smelt, *O. viridiscens*, as being suggestive of the vast amount of fish food accessible to marine species in winter as well as in summer. The vial contains three shrimps, one of the small fry of some other fish, and a half dozen fish ova not quite as large as those of our brook trout. The ova have made no progress in the process of incubation, from which I infer that they were seized by the *Osmerus* as soon as they were ejected, or not long after they were deposited by the parent fish. In observing the habits of both species above referred to, I have found them to go to the head of tide, but no further, for the purpose of spawning. This occurs as soon as the rivers are free from ice in the spring, when the northern smelt is taken in such numbers from the Gulf of St. Lawrence as sometimes to be used as manure.

Description of Nine Species of UNIONIDÆ from Lake Nicaragua, Central America.

BY ISAAC LEA.

In the "Proceedings of the Acad. of Nat. Sci.," April, 1856, I described a new species of *Triqueta* (*Hyria* Lam.), which I called *lanceolata*. It was made from a single valve in a collection from China. In the diagnosis made in the Proceedings it was not mentioned that this valve was somewhat twisted, being fearful that the curved condition arose from accidental circumstances, and not from a normal condition like *Arca tortuosa*, Lin. Subsequently, in the "Journal of the Academy," vol. iii, and in "Observations on the Genus Unio," vol. vi, I published a full account of this peculiarly interesting species, having received perfect specimens, one of which was well figured. In this paper I thought that, as the original name of *lanceolata*, made from a single imperfect valve, did not apply to the perfect shell, science would be subserved by a descriptive name. I proposed to call it *contorta*, and redescribed it under that name with full remarks and observations. At that time it was the only member of the family *Unionidæ*, which was known not to be *equivalve*. Subsequently, in describing a species of *Spatha*, under the name of *Natalensis*, I mentioned that it was "slightly inequivalve." "Journal Acad. Nat. Sci.," vol. vi, and in "Observations on the Genus Unio," vol. xi.

In 1865 I published in the "Proceedings of the Academy" the diagnosis of a new *Unio* from China, which is *inequivalve* and twisted. This I named *tortuosus*. The full description and figure, with remarks, is in a paper which I have prepared for the Journal of the Academy. These constitute all the *inequivalve* species of the family which I have seen until recently.

The collection made by the late Mr. Thomas Bridges, botanist, who, during his travels in Central America, visited Lake Nicaragua, has been kindly placed in my possession, part by Col. E. Jewett, and part by Mr. W. M. Gabb, Palæontologist of the California Geological Survey. Very much to my surprise and satisfaction I found that several species of *Unio* and *Anodonta* had this *inequivalve* character.

It may be here remarked that there seems to be a predisposition, in the *Unionidæ* of Central America, to this very unusual character in the *Unionidæ*,

[March,

while in Mexico, United States and Canada, where so many species have been described, there has not been a single one observed. These observations and the following list will, I hope, induce more attention to the investigation, by students of Fresh-water *Mollusca*, of this interesting branch of inquiry.

List of inequivalve Unionidæ.

| | |
|-----------------------------------|--------------------------------------|
| Triquetra contorta, China. | Unio encarpus, Central America. |
| Spatha Natalensis, Africa. | Unio Nicaraguensis, Central America. |
| Unio tortuosus, China. | Anodonta inæquivalva, Cent. Amer. |
| Unio Newcombianus, Cent. America. | Anodonta Granadensis, Cent. Amer. |
| Unio Gabbianus, Central America. | Anodonta lenticularis, Cent. Amer. |

UNIO NICARAGUENSIS.—Testa sulcata, triangulari, compressa, aliquanto *inæquivalva*, inæquilaterali, postice obtuse angulata, antice oblique truncata; valvulis crassiusculis; natibus prominentibus, subacutis; epidermide olivacea, crebris sulcatis indutis, radiata; dentibus cardinalibus erectis, compressis, crenulatis et in valvulo dextro tripartitis; lateralibus brevibus fonicatisque; margarita argentea et iridescente.

Habitat.—Lake Nicaragua, Central America. Mr. W. M. Gabb.

UNIO GRANADENSIS.—Testa sulcata, elliptica, subinflata, inæquilaterali, postice subangulata, antice rotundata; valvulis crassiusculis, antice crassioribus; natibus subprominentibus; epidermide tenebroso-fusca, nigricanti, eradiata; dentibus cardinalibus parvisculis, compressis, erectis crenulatisque; margarita alba et iridescente.

Hab.—Lake Nicaragua, Cent. Amer. Col. E. Jewett and Mr. W. M. Gabb.

UNIO ENCARPUS.—Testa sulcata, subtriangulari, subinflata, aliquanto *inæquivalva*, inæquilaterali, postice obtuse angulata, antice rotundata; valvulis subcrassis, antice crassioribus; natibus prominentibus; epidermide tenebroso-olivacea, encarpiformi, eradiata; dentibus cardinalibus compressis, erectis, crenulatis, in valvulo dextro subtripartitis; lateralibus obliquis rectisque; margarita albida et iridescente.

Hab.—Lake Nicaragua. Mr. W. M. Gabb.

UNIO GABBIANUS.—Testa sulcata, triangulari, subinflata, aliquanto *inæquivalva*, inæquilaterali, postice triangulari, antice oblique truncata; valvulis crassiusculis, antice aliquanto crassioribus; natibus prominentibus, ad apices retusis; epidermide tenebroso-olivacea, obsolete radiata; dentibus cardinalibus erectis, compressis et valde crenulatis; lateralibus curtis, obliquis striatisque; margarita argentea et iridescente.

Hab.—Lake Nicaragua, Cent. Amer. Col. E. Jewett and Mr. W. M. Gabb.

ANODONTA BRIDGESII.—Testa lævi, oblonga, inflata, inæquilaterali, antice et postice rotundata; valvulis pertenuibus; natibus prominulis; epidermide lævissima, micanti, olivacea, obsolete radiata; margarita elegantissime iridescente.

Hab.—Lake Nicaragua, Cent. Amer. Mr. Thomas Bridges.

ANODONTA INÆQUIVALVA.—Testa lævi, obovata, compressa, *inæquivalva*, inæquilaterali, antice et postice rotundata; valvulis subtenuibus; natibus subprominentibus; epidermide vel luteo-viridi vel tenebroso-viridi, obsolete radiata; margarita cæruleo-alba et valde iridescente.

Hab.—Lake Nicaragua, Cent. Amer. Mr. W. M. Gabb.

ANODONTA JEWETTIANA.—Testa lævi, suboblonga, valde inflata, inæquilaterali, postice rotundata, antice oblique rotundata; valvulis tenuibus; natibus prominentibus, inflatis; epidermide olivacea, transverse striata fere sulcata, obsolete radiata; margarita argentea et valde iridescente.

Hab.—Lake Nicaragua, Cent. Amer. Col. E. Jewett.

ANODONTA LENTICULARIS.—Testa lævi, subrotunda, compressa, *inæquivalva*, 1868.]

inæquilaterali, antice et postice rotundata; valvulis subtenuibus; natibus prominulis; epidermide transverse striata, tenebroso-viridi, redundater radiata; margarita cæruleo-alba et valde iridescente.

Hab.—Lake Nicaragua, Cent. Amer. Mr. W. M. Gabb.

ANODONTA GRANADENSIS.—Testa lævi, elliptica, subinflata, *inæquivalva*, inæquilaterali, postice obtuse angulata, antice rotunda; valvulis subtenuibus; natibus prominulis; epidermide vel lutea vel viridi-radiata; margarita cæruleo-alba et valde iridescente.

Hab.—Lake Nicaragua, Cent. Amer. Col. E. Jewett.

An Examination of the REPTILIA and BATRACHIA obtained by the Orton Expedition to Equador and the Upper Amazon, with notes on other Species.

BY E. D. COPE.

The expedition for purposes of scientific exploration, to which the present paper relates, was undertaken during the autumn and winter of 1867—8, under the auspices of the Smithsonian Institution. Prof. James Orton, of Williams College, Massachusetts, directed the expedition, which was composed mainly of students of the same institution. This enterprise, particularly worthy of a popular institution of learning of the grade and position which an American College ought to occupy, has been attended with success in many departments of natural and physical sciences. In the present department, valuable in furnishing a reliable key to the history of the mode of creation and distribution of animal life, a considerable amount of material has been collected, which is reviewed summarily in the following pages.

The party divided, a portion ascending the Orinoco River to meet the other portion in Eastern Equador. The course of the latter was as follows, as I am informed by Prof. Orton:

They first touched the continent at Payta, Peru, and afterwards at Guayaquil; then proceeded inland over the Andes to Quito—collecting in the valley about three months; thence via Pafallacta (on the east slope of the eastern Cordillera) and Archiaona (the largest town in the Oriental part of Equador,) to Napo on the River Napo; thence by canoe down the Napo to the Marañon and Amazons.

They collected Reptiles chiefly from Guayaquil, Pallatanga (on the west slope of the western Cordillera south of Chimborazo); Ambato (in Valley of Quito); western slope of the volcano Antisana, 13000 ft. above sea (a small black frog); Archiaona—in the depths of the Napo forest (lizards chiefly); Santa Rosa on the Napo (lizards chiefly); Pebas, Peru, on the Marañon—2200 miles from the Atlantic (snakes chiefly,) and Tabatinga on the Brazilian frontier, (snakes chiefly.)

CROCODILIA.

CROCODILUS AMERICANUS Linn. *C. acutus* Cuv.

From Guayaquil.

TESTUDINATA.

TESTUDO ELEPHANTOPUS. Harlan.

From Guayaquil, identical with sp. from the Gallapagos Islands. This species presents the broad posterior vertebral shield of the American *T. tabulata* and *polyphemus*.

CHELYDRA SERPENTINA Linn. Schweigger.

One sp. from Guayaquil, identical with nearctic specimens. This species furnishes a case of distribution unparalleled among reptiles, ranging as it does from the cold regions of Canada to the torrid region of Equador. Peters has already noticed Guayaquil as its most southern habitat, via Monatsber., Berlin Ac. 1862, p. 627.

[March,

SAURIA.

NYCTISAURA.

PHYLLODACTYLUS REISSII Peters, Monatsberichte, Preuss. Ac. Wiss. 1802, 626.

Several specimens of this handsome species from near Guayaquil.

GONIODACTYLUS CAUDISCUTATUS Günther. Proc. Zool. Soc. Lond. 18 , p. .
From near Guayaquil.

GONIODACTYLUS FERRUGINEUS Cope. *Gonatodes ferr.* Cope, Proc. A. N. Sci. Phila. 1863, 102.

From the Napo and Maranon.

A Central American species of this genus is *G. fuscus* (*Stenodactylus* Hallowell. *Gymnodactylus scapulatus* Duméril. The *G. tenuis* of Hallowell is a *Eublepharis* Gray, from the Philippine Is.) *G. gillii* Cope. (l. c. 1863, 102) is *G. vittatus* Licht. von Martens Nomencl. Mus. Berlin. Was the latter ever properly published?

THECADACTYLUS RAPICAUDA Gray, Houttuyn.

From the Napo and Maranon. Identical with specimens from Yucatan and St. Thomas, W. I.

PLEURODONTA.

IGUANA TUBERCOLATA LAUR.

One sp. (No. 6645) from Napo or Upper Maranon.

BASILISCUS MITRATUS Duméril. *Ptenosaura seemannii*, Gray.

Near Guayaquil.

HYPSIBATES AGAMOIDES Weigmann.

Napo and Maranon.

LIOCEPHALUS IRIDESCENS Günther, Proc. Zool. Soc. Lond. 1859, icon optima!

Specimens from the Plateau of the Andes, near Quito, No. 6710, and from near Guayaquil.

MICROLOPHUS PERUVIANUS, Girard.

Paita, Peru.

ANOLIS VIRIDIAENEUS Peters, Monatsberichte Preuss. Ac. Wiss. Berlin, 1863, 147,

From Napo or Upper Maranon.

ANOLIS ORTONII Cope, sp. nov.

Of the same group as the last, that is, with smooth abdominal scales, and the median series of caudal scales not larger than the lateral; the tail is, however, only partially preserved, and as it is somewhat compressed the character of the vertebral scales may have been different in the lost portion.

Muzzle convex, wider than long, (measuring at anterior angle orbit,) covered with scales of different sizes. Occiput small, separated by several rows from superciliaries. Scales between the facial rugæ hexagonal, smooth, in four longitudinal rows, a little smaller than the plates of the rugæ which extend to the central row. Dorsal and lateral scales granular, nearly equal, and smaller than the rounded ventrals. Brachial scales a little larger, weakly keeled, anti-brachials much larger, keeled. Labials 8—8, the two posterior very small; loreal rows six. Frontal cavity distinct; superciliaries separated by one row scales. Sides of muzzle with longitudinal, smaller, weakly keeled scales. Auricular meatus two-fifths length eye fissure. Infralabials longitudinal smooth, in two or three rows. Supraorbital disc of some seven broad smooth plates, separated from superciliaries by a row of granular scales. Gular fan large.

When the limbs are extended the end of the metacarpal reaches end of muzzle, and the longest toe nearly reaches the orbit. The digital dilatations are well developed.

Top of head, nape, a rather narrow dorsal region and upper surfaces of limbs blackish coppery; sides and below golden, fan deep saffron yellow.

1868.]

| | Lines. |
|--|--------|
| Length from end of muzzle to vent..... | 21.6 |
| " " " " axilla..... | 9.1 |
| " " " " ear..... | 5.5 |
| Greatest width head | 3.6 |

From Napo or Upper Marañon.

This handsome lizard differs from *A. veridiaeneus* Pet. in the shorter muzzle with larger plates and fewer large labials, and in the shorter limbs, as well as in coloration. I take pleasure in dedicating this species to Prof. Jas. Orton, of Williams College, to whom Science is indebted for this and other species of much interest included in the present essay.

DIPLOGLOSSUS MONOTROPIS Weigmann, Peters. *Camilia jamaicensis* Gray, Catal. Liz. Brit. Mus. 118.

This large scink is not an inhabitant of Jamaica, as given by Dr. Gray, but of Ecuador, as given by Prof. Peters in Mus. Berlin. I cannot think it right that the species should bear the name erroneously given, and accordingly adopt Weigmann's as above.

One sp. (No. 669†) from Guayaquil.

CENTROPYX PELVICEPS Cope, sp. nov.

This species bears much resemblance in structure and coloration to the *Monoplocus dorsalis* Günther, and would seem to be a mimetic representative in an allied genus. The presence of femoral pores in both sexes separates it generically, and the three additional series of abdominal plates is a marked specific feature.

Dorsal scales small, hexagonal, keeled, graduating into the smaller lateral; abdominals large, keeled and mucronate in fourteen rows; preanals smooth, of equal size (except a marginal row of small ones) in three oblique series. Spurs large, appressed, two on each side. Caudal scales large, strongly keeled. Large scales on top of foot, tibia below, femur in front and below, fore arm above, humerus above and behind. Collar of a row of large mucronate scales, with three smaller series anterior. Middle gular region with scales little larger than the lateral. Nineteen pores on each femur.

The head slightly compressed, elevated, the superciliary ridges bounding a median concavity and continued back into a strong ridge which follows the margin of the occipital plates and encloses the plates of the parietal region in a deep basin. This margin is cordate behind. In younger specimens this elevation is not prominent, and is entirely absent from specimens of length of (head and body) two inches and less. Rostral shield nearly prolonged back to internasal; the latter broad as long, with straight lateral margins. Frontonasals in extensive contact. Frontal longer than broad, undivided, angulate before and behind. Frontoparietals elongate; interparietal wider than parietals, surrounded by the latter and occipitals, which form a regular disc, emarginate behind and extending nearly to the zygomatic angles. Nuchal scales granular. Nostril on naso-frenal suture. Two frenals, the anterior much the larger, the posterior not extending above the three or more small preoculars. Suboculars two or (divided) three. Superior labials six, inferior five. A symphyseal, a postmental, and on each side three large and two small infralabials, the anterior pair separated by a row of granules. Molar teeth tricuspid, the lateral cusps nearly as long as the median, but much narrower. Premaxillaries eight. Toes long, claws curved; outer toe markedly longer than inner.

Color in spirits bluish green, with a pale dorsal band from the nape to beyond the middle of the back; this is bounded on each side by a heavy black band of the same length, which sends in short branches nearly meeting similar ones from the other. In younger specimens the light dorsal band is brighter and extends from the tip of the muzzle; it is more frequently crossed by black bars. In these short black bars descend on the sides, and cross the upper surface of the tail. Yellowish olive below in all.

[March,

| | In. | Lin. |
|--|-----|------|
| Total length of adult..... | 14 | 6 |
| Length to vent..... | 4 | 7 |
| “ axilla..... | 2 | 1 |
| “ to most posterior part of head shield..... | 1 | 3 |
| “ to anterior margin orbit..... | | 7 |
| Width at prefrontal angle..... | | 4.5 |
| “ at nostrils..... | | 2.5 |
| “ at angles mandibles..... | | 9.5 |
| Length fore limb..... | 1 | 10.5 |
| “ hand..... | | 8.75 |
| “ hind limb..... | 3 | 7.1 |
| “ tibia..... | 1 | 1.5 |
| “ foot..... | | 10. |

Specimens of this species (No. 6638) from the Napo or Upper Amazon of Ecuador.

AMEIVA PETERSII Cope, sp. nov.

Ventral plates in ten series; heel without horny tubercles. Two series of plates on under surface of tibia; frontal plate undivided, four supraorbitals. Inner toe longer than outer, both short. Brachial shields in three rows just continuous with the two series of antebrachials. Two pairs of parietal plates. Gular scales considerably larger on the middle of the posterior border; median scales of posterior fold larger than marginal. Preanal plates scale-like, small, two larger in the centre. Dorsal scales minute, keeled; interparietal plate wider than parietal, frontal narrowed behind; prefrontals well in contact; one large loreal. Postmental plate longer than wide, infralabials five continuous and three pairs posterior oblique. Numerous small plates behind the parietals; caudal plates keeled.

Color bright olive, with a narrow yellow band from below orbit to groin, banded above by a broad black band, which is marked by several white dots behind the scapular region, and is bounded above in front by a pale green line to orbit. A narrow dark band from below orbit to groin below the yellow. Sides blackish and pale spotted. The only specimen being young, the coloration of the adult is probably nearly uniform green.

| | In. | Lin. | | In. | Lin. |
|--------------------------------|-----|------|-----------------------|-----|------|
| Total length..... | 4 | 10.5 | Length fore limb..... | | 8.6 |
| Length head and body..... | 1 | 9 | “ hind limb..... | | 17 |
| “ to edge parietal plates..... | | 6 | “ foot..... | | 9.5 |
| “ “ orbit..... | | 2.5 | | | |

No. , from the Napo or Marañon.

The species is nearest *A. laeta* Cope, but is quite different in the preanal and parietal plates and gular scales. It is dedicated to Prof. Wilhelm Peters, of the Friedrich Wilhelm's University of Berlin, who has added much to Herpetology.

TEIUS TEGUEXIM Gray. *Tupinambis* Daud.

One sp. (6644) from Napo or Upper Amazon.

EUSPONDYLUS STRANGULATUS Cope, sp. nov.

This species is very distinct from others described, in the alternation of the dorsal transverse series of scales, the minuteness of those of the sides, nape and gular region, and in the constriction of the neck.

The general form is slender, the body not depressed, the tail of moderate length and considerably compressed. Neck much compressed, head elevated, flat above, muzzle short, compressed. Rostral truncate behind, internasal subquadrate, broad as long, frontonasals longer than broad. Frontal narrower, frontoparietals elongate; interparietal longer than broad, convex behind and projecting beyond parietals. Parietals one pair, in contact with supraorbitals, broader than long. Four well marked supraorbitals, without surrounding granules; five superciliary plates, posterior not smaller. Two loreals, the

posterior below the other and continuous with the suborbital plates. The latter small, six, median pair smaller, all separated from orbit by granules. Temporal region with some flat plates, side of head granular, no auricular plates. Meatus auditorius large. Six upper, six lower labials; postgenial large; four large infralabials, two pairs in contact. Gular scales small, larger near rami and collar. Latter distinct, but not free, extending in front of axilla. Abdominal plates in eight rows, larger than dorsal scales, subquadrate, continuous by two rows with preanals; latter four, posterior pair much larger. Scales of tail smooth below, very weakly keeled above. Dorsal scales separated by a wide lateral granular region, one row of the former resolving itself into two of the latter.

The dorsal scales are in transverse series, which alternate with each other on the median line. They are weakly keeled, longer than broad, and rectangular; they grow smaller on the interscapular region, and disappear shortly in advance of it. Thirty rows between axilla and groin; 10—12 longitudinal.

Digits all well clawed, and with one row of scales below; longest finger .75 distance to groin when extended; longest toe to the gular fold in like manner. Antebrachium plated above and below; brachium above and behind. Femur plated in front only, tibia below only. Outer toe nearly as long as second, inner short.

Color (in spirits) above olivaceous; sides bluish, with a few very pale dots, hind face of femur similar; under surface head and body light yellow.

| | In. | Lin. |
|--------------------------------------|-----|------|
| Total length..... | 7 | |
| Length to vent..... | 2 | 5-5 |
| “ to collar..... | | 10-5 |
| “ to end of interparietal plate..... | | 6 |
| “ to eye fissure..... | | 2-5 |
| “ of forelimb..... | | 10-4 |
| “ of hind limb..... | 1 | 3 |
| “ “ foot..... | | 7-75 |
| Width head at angle mandible..... | | 4-5 |
| “ “ prefrontal bones..... | | 2-5 |
| “ “ nostrils..... | | 1-5 |

I take the present opportunity of correcting a lapsus calami in a former review of the higher groups of the Reptilia Squamata, where I included the Ecpleopodidae under the head of families with the temporal fossa with bony roof. This roof is really dermal only, as in the Ameivæ, as already mentioned by Peters.

MABUIA CEPEDEI Gray, Cope, Proc. A. N. Sci. Phila. 1862, 186.

One sp. (6647) from Napo or Upper Marañon.

OPHIOGNOMON TRISANALE Cope, gen. et sp. nov.

Fam. Chalcididae. Nostril on the suture between the first labial and supranasal. Head shields above five, viz., two supranasals, one frontal and two occipitals. Limbs minute, four, without digits. Scales smooth, hexagonal, in annuli, those behind vent with a minute pore each. A short longitudinal-fold behind axilla. No collar.

This genus is near Chalcis, but differs in the position of the nostril and character of the head shields. The latter above are much like those of some Mexican genera of Calamarian serpents, especially Sympholis Cope—name from *ὄφις*, serpent, and *γνώμων*, a sign.

Char. specif. Muzzle obtuse, slightly projecting, rostral plate visible from above. Supranasals extensively in contact with each other and the first and second upper labials. Frontal large, hexagonal, posterior angle prolonged; parietals larger, obliquely hexagonal, truncate behind. Two superciliaries; four superior labials, posterior largest, truncate behind; temporals three on each side, anterior large. Two very small suborbitals, one minute preocular and a square loreal. Symphyscal narrow, inferior labials three, posterior lanceolate. Geneal rhombic, large; infralabials three on each side, anterior pair

[March,

extensively in contact, the posterior smaller and separated from temporals by four narrow plates, and from each other by four plates. The median pair of the latter are the larger and join the anterior pair of infralabials. A groove surrounds the throat behind the jaws, which is succeeded by five annuli of equal ovate scales. These are followed by a cross series of six more elongate, which precede a pair of large sternal plates extending between fore limbs. Abdominal scales different from the dorsal, truncate, not hexagonal, in six series. Dorsals in fourteen longitudinal, thirty-seven transverse rows between axilla and groin. Three elongate parallel anal plates; a series of seven small quadrate scales behind vent, each with a pore in the centre. Caudal scales below, angulate like dorsal.

Hind limbs style-like, minute, half as long as anal plates. Fore limbs as long as three anterior labials, consisting of humerus, forearm and carpus, but no digits; three terminal tubercles are probably metacarpal. Tail very long, subquadrate in section; the portion preserved, though nearly as long as the body, presents no diminution of diameter; the general form is probably snake-like, as in *Ophiosaurus*.

| | In. | Ln. |
|-----------------------------------|-----|------|
| Length head to rectus oris..... | | 2.25 |
| “ “ to gular fold..... | | 3.75 |
| “ “ to axilla..... | | 6.5 |
| “ “ to groin..... | 2 | 5 |
| “ “ to vent..... | 2 | 6.25 |
| Width head at angle mandible..... | | 2 |

Color: below brown; sides with a brown blackish band, which is bounded above by a rather narrow yellow band which commences on the superciliary region. Dorsal region between the latter yellowish gray, bounded exteriorly by a distinct blackish line, and divided medially by an indistinct blackish line. The colors of the tail are similar. Head brownish, paler below.

This species presents several points of resemblance to the *Chalcides dorbignyi* Dum. Bibr. The specific differences, apart from the generic, may be readily observed on comparing the descriptions. This is no doubt a sluggish animal, and moves much in the manner of a snake. It is the most snake-like of the Chalcididae, approaching somewhat the *Amphisbænia*.

One spec., No. 6637, from the Napo or Upper Marañon.

AMPHISBÆNIA.

AMPHISBÆNA FULIGINOSA Linn. *A. americana* Schreber, Gray.
Napo and Marañon.

OPHIDIA.

SCOLECOPHIDIA.

TYPHLOPS RETICULATUS Linn.
Napo and Marañon.

ASINEA.

TRACHYBOA GULARIS Peters, Monatsberichte Acad. Berlin, 18 , p. *Enygrus*, Jan.

The character of the rostral shield appears to separate this genus from *Enygrus*, as Peters observes; the cranium is quite similar to that of *Ungualia* Gray. From Guayaquil (No. 6683.)

BOA CONSTRICTOR Linn.

The loreal plate larger than the preocular; two rows scales between orbit and labials. No vertical or loreal brown band.
Guayaquil.

XIPHOSOMA HORTULANUM Wagler. *Boa* Linn.
From Napo or Upper Amazon. (6679.)

NINIA ATRATA Cope. *Coluber atratus* Hallowell, *Streptophorus drossii* Dum. Bibr.
Elevated valley of Quito.

1868.

RHABDOSOMA MICORRHYNCHUM Cope, sp. nov.

Seventeen series of scales; supralabials seven, the first very small, the third and fourth entering the orbit. Prenasal larger, very nearly reaching lip. Prefrontals very small, equal postnasal, one-sixth the size of postfrontals. Latter longer than broad. Rostral contracted above by approach of prenasals. Loreal very long. No preocular, on one side two, on the other one postocular. Last upper labial longer than high. First pair of labials united; two pair only in contact with genials. Frontal subtriangular; occipitals elongate. Temporals 1—2. Total length 4 in. 7.5 lin.; tail 8 lin.

Coloration like that of a *Tantilla*. Above dark brown, beneath pale brown, with a faint line along the margins of the gastrosteges. Top of head blackish, brown behind; a partially complete yellow collar, which widens at the angle of the jaws. A deep brown band from eye to angle of mouth; upper labials yellow brown edged.

Tail slender acute.

No. 6693, from Guayaquil. Nearest the *R. badium* D. B.

TANTILLA MELANOCEPHALA. *Calamaria* Schl., *Homalocranium* D. B.

Two specimens, the longest measuring 17 inches. In both the postfrontals and labials are in contact, as in our other specimens, and as given in a synopsis of the genus (Proc. Acad. 1861, 74,) and not separated by postnasal and preocular in contact, as given in Jan's Iconographie.

From the valley of Quito.

OPHEOMORPHUS TYPHLUS Cope, Proc. A. N. Sc. 1862. *Coluber* et *Xenodon typhlus* auctorum.

From Marañon or Napo.

OPHEOMORPHUS ALTICOLUS Cope, spec. nov.

Scales in seventeen rows, all rather broad. General form typical, head distinct, plane. Rostral plate flat, very broad, advancing by its whole posterior convex margin on the internasals. Latter broader than long. Frontal with straight, nearly parallel sides, not encroaching on the superciliaries in front; front margin not quite equilateral. Occipitals a little narrowed and divaricate behind. Nasals narrow, postnasal longer than high; loreal very small, quadrate, on one side confluent with postnasal, and not encroaching on the single preocular. The latter is therefore wide; it just appears on the upper plane. One large postocular, the place of a small inferior is occupied by the angle of the large sixth upper labial.

Superior labials eight, seventh higher than long, fourth and fifth and scarcely the third entering orbit. Temporals $\frac{1}{2}$, the anterior only enlarged. Inferior labials ten, six in contact with the genials; the pairs of the latter about equal.

Total length 24 in. 6 lin.; length of tail 5 in. 2 lin.; of gape of mouth 9 lin.

Above green; lower surfaces with lips, and lower part of rostral plate, yellow, separated from nostril to rictus oris from the green by a black band. A black line commences about the length of the tail in advance of the vent, on the suture of the third and fourth rows of scales, and extends to the end of the tail on each side.

From the elevated valley of Quito. No.

Since its establishment by the author, in 1862, this genus has received several additions. The species known are as follows:

O. cobella L. *O. breviceps* Cope. *O. doliatus* Neuwied. *O. merremii* Neuwied. *O. alticolus* Cope. *O. typhlus* Linn. *O. viridis* (*Liophis viridis* Günther, Ann. Mag. N. H. 1862). *O. dorsalis* Peters, (*Liophis d.*, Monatsberichte Ac. Wiss. Preuss. 1863, 283).

LIOPHIS REGINÆ Linn., Wagler. *Coronella* Schl.

From Napo and Amazon.

LIOPHIS ALMADENSIS. *Natrix almada* Wagl. *Liophis wagleri* Jan.

The adult; the specimen figured by Wagler and Spix appears to be young. Napo and Marañon.

[March,

LIOPHIS PYGMÆUS Cope, sp. nov.

This species is much the smallest of its genus; in size and appearance it is like a burrowing snake of the *Calamariæ*, but its dentition, squamation, pores, and even style of coloration, are those of this genus. It is undoubtedly adult or nearly so.

Head slightly distinct, ovate, narrowed in front, muzzle slightly prominent. Rostral plate much broader than long, just visible from above. Internasals broader than long. Frontal large, elongate, longer than muzzle in advance of it, sides straight; superciliaries rather narrow. Occipitals elongate, including a notch behind, each bounded by two large temporals and $1\frac{1}{2}$ small scales. Postnasal lower than prenasal, loreal still lower, subquadrate encroaching on the preocular. Latter scarcely visible from above. Postoculars two, inferior half superior, both in contact with temporal. Upper temporal bounded by three scales, anterior larger, joining last labial. Superior labials seven, third and fourth entering orbit, sixth largest. Inferior labials eight, five in contact with genials. Latter, pairs equal.

Scales in seventeen rows, uniporous, those of the first larger.

Total length 7 in. 2 l.; tail 1 in. 1.5 lin.; that is 6.3 in the whole. Thus this portion is shorter than in the genus generally; it is quite stout. Gastrosteges 12-8, anal 1 | 1, urosteges 31.

Above deep olive, leaden on the sides and the ends of the scuta. Below uniform yellow. A black line from orbit to anterior lower angle of last labial. A broad black collar which encroaches on the occipitals, which is directed backwards and does not reach the gastrosteges. Continuous with the extremity of this, on the second, third and fourth rows of scales is a series of small black spots separated by intervals of from three to two rows; near the middle of the length these join and form a black band, which extends to the end of the tail. The median dorsal region becomes darker, and on the posterior fourth forms an indistinct band. Where the epidermis is lost and the skin is stretched the scales are white-edged. Top of head darker brown than sides. Lips not margined.

One specimen, 6,668, from Napo or neighboring pt. of Marañon.

DROMICUS LATERISTRIGA? *Liophis lateristriga* Berthold, Jan's Iconographie des Ophidiens.

The individuals in the collection differ from Jan's figure in a less distinct lateral stripe, and presence of occipital cross-band. It is not probably distinct. A description is, however, added:

Body cylindric, head flat, muzzle short. Scales in seventeen rows. Superior labials eight, fourth and fifth margining orbit, second to sixth inclusive, higher than long. Loreal higher than long; nasals nearly equal; one large, one small inferior preocular; the superior sometimes divided. Postoculars two, both in contact with the only elongate temporal. The latter is followed by two rhombic temporals, the first one above the seventh and eighth labials; and two scales on margin of occipital. Occipitals narrowed behind, as long as width between outer margins of superciliaries behind. Frontal, anterior and superciliary borders equal; prefrontals broader than long, rostral scarcely visible from above, much broader than high. Length of muzzle from opposite anterior margin eye, equal width frontal and one superciliary shield in front. Inferior labials eight, fifth largest, seventh next. Posterior genials equal anterior. Gastrosteges 155; anal 1 | 1; urosteges 69+; tail probably one-third or more lost.

Color above, a rich dark brown, the sides of the head darker; an irregular yellow band passes across the middle of the superior labials and passes round the nape on the fifth row scales behind the occipital plates and joins its fellow. A yellowish band passes along the outer margins of the two pairs of frontals, the superciliaries and the anterior third of the occipitals, interrupted at each suture. The dark of the upper surface extends on the gastrosteges, and is traversed for a considerable part of the length, and by a faint line forward, by a streak 1868.]

on the middle of each scale. A similar line, equally indistinct, traverses the scales of the fifth row, becoming more apparent on the tail. Color of lower surfaces deep orange red; lower labials and chin blackish.

Length of head and body 16 in. 9 lin.

This species is nearest the *D. brevirostris* Peters,* and *D. temporalis* Cope. The two preorbitals, single large temporal, coloration and other points distinguish it. Its form is that of *Pliocercus* Cope, but belongs to *Dromicus* on account of its diacranterian dentition.

Two specimens (6702) from the elevated valley of Quito.

TACHYMENIS CANILATUS Cope, sp. nov.

This species differs from the known species in a more slender form; and in general appearance approaches the *Lygophis elegans* of Tschudi.

Scales in nineteen rows, elongate, thin, with single terminal pores. Superior labials eight, fourth and fifth bounding orbit, sixth larger than seventh. Inferior labials ten, fifth and sixth long and narrow. Posterior genials longest. Nasals large, distinct; loreal long as high, lower in front; preocular single, just reaching vertical; postoculars two. Temporals 1—1—2, the middle one largest. Parietals narrowed behind, whole plate one-fifth longer than frontal, common suture one-fifth shorter than same. Frontal narrower than each superciliary, spreading a little in front. Muzzle flat, internasals longer than broad, canthus rostralis strong. Rostral small, flat. Gastrostege 199, anal 1—1, urosteges 98. Total length 18 in. 4 l.; of tail 5 in. 4; of gape 5 lin.

Color leaden gray on the sides, bounded above on the sides by a faint blackish streak; dorsal region brownish grey, with a double row of brown spots, when confluent covering five rows of scales. On the posterior half the body and tail they unite into a vertebral band, which is separated from the gray of the sides by a pale brown band. A dark band through frontal plate, split by a pale one; a pair of white dots on the parietals, as in *Tropidonotus* sp. Lips and belly below light yellow, the former brown-specked medially, black margined above posteriorly. A brown band outside of muzzle. Each gastrostege with a row of brown dots its whole length.

This species was not obtained by the Orton expedition, but was sent from Guayaquil to the Smithsonian Institution in a collection made by Messrs. Destruger and Reeve.

CONIOPHANES DROMICIFORMIS Cope, Proc. Acad. 1866, 128. *Tachymenis dromiciformis* Peters, Monatsberichte Preuss. Ac. 1863, 273.

In four specimens of this species I find no scale-pores, and but one preocular. Prof. Peters describes scale-pores as present in his types, but I failed to see them on examination of the same specimens, which he permitted me to make. This character alone distinguishes this genus from *Tachymenis*, though I ascribed the same importance, on a former occasion, to a supposed difference in the number of preocular plates. That this is of little value in this case, I can now agree with Peters in believing.

From Guayaquil. No. 6689.

RHADINÆA CHRYSOSTOMA Cope, sp. nov.

This species agrees with those of *Rhadinæa* in technical characters only. Its proportions are those of *Opheomorphus*, from which it differs in the entirely equal teeth. It might be referred to *Hypsirhynchus*, but in that genus there is a single scale-pore, in the present they are wanting. The vertebrae are not furnished with hypapophyses on the posterior third of the length, but are keeled below.

Head elongate oval, quite distinct; muzzle truncate when viewed from above or in profile, not projecting. Rostral plate scarcely visible from above; prenasal higher than postnasal; loreal high as long, encroaching very little on preocular, which latter does not reach frontal. Oculars 1—2, temporals 1—2.

* Monatsberichte Preuss. Academie Wiss. 1863, 280.

† Proc. A. N. Sci. 1860, 307.

Anterior touching both postoculars. Labials 8—10; the upper with fourth and fifth entering orbit, chiefly the fourth, which is longer than fifth. All longer than high, the seventh largest, longer above than on labial border. Genials long, anterior longer than posterior. Frontal elongate with nearly parallel and slightly concave sides; occipitals moderate, narrowed behind. Scales in seventeen rows, all of nearly equal size and rather broad.

Total length 8 in. 4 lin.; of tail 1 in. 6 l.; of gape 5.35 lines. The tail is thus as short as in *Opheomorphus*. Eyes rather small. Internasals about as wide as long. Gastrosteges 157; anals 1 | 1; urosteges 57.

Upper surface of head and body dark-brown, which is bordered, except just behind the head, by a series of small round brown spots on each side, which become a band on the posterior fourth. Below this and ground of belly yellow, which is prolonged as a band along upper labials to rostral, leaving a black labial margin. Belly with black cross-bars and halves, more sparse posteriorly, confluent anteriorly on the fourth of the length; this is here and there spotted with yellow.

From the Napo or Maranon. No. 6665. This single specimen is probably not fully grown.

MASTICOPHIS PULCHRICEPS Cope, sp. nov.

This species is described from a specimen twenty-one inches long, and not probably adult. The coloration of the dorsal region has considerable resemblance to that of the young of *M. rappii* Gthr.

Rather slender, the head quite distinct, rather short, somewhat flattened and with broad muzzle. Tail 3.6 times in the total length. Superior labials eight, the anterior short, the two posterior elongate, the third, fourth and fifth in contact with the eye, the fifth and sixth elevated. Orbitals one—two; the loreal higher than long; temporals 2 | 2 on each side, the upper anterior the smallest. Internasals broader than long, rostral prominent, scarcely visible from above. Frontal little concave laterally, least width little less than .5 length and equal greatest width the superciliaries. Greatest length occipitals exceeds same of frontal; they are truncate behind, and with straight outer margins. Inferior labials ten; pregenials much shorter than postgenials.

Scales of body smooth, in seventeen rows, second as large as the others. Gastrosteges 170, anal 1 | 1, urosteges 100.

Ground color above and below dark-blue gray, which is largely obscured in the following manner: A series of quadrate black spots extends from nape to near end of tail, alternating with a lateral series of the same, without line of demarkation between. Each spot is separated from the next by a cross-bar of ground color, in which all the scales are white-edged. These bars are prolonged on the gastrosteges, and their extremities fall into a line of yellow spots on a blackish band, which extend on each side to vent. The cross-bars are only one scale wide. A black nuchal crescent, which extends as a band on each side through orbit round end of muzzle. This sends a bar to the edge of the lip at the orbit and angle of mouth, which connect on the lip. Gular region black with numerous yellow spots. Top of head dark brown, with numerous paler brown marks within the margin of each scale.

One sp. (6704) from the plateau valley of Quito.

MASTICOPHIS BRUNNEUS. *Herpetodryas brunneus* Günther, Catal. 116. *Drymobius* Cope, Pr. A. N. Sci. 1860.

Two sp. (6705), one from Guayaquil and one from valley plateau of Quito. Both belong to a variety with an indistinct series of small dark spots on each side of the vertebral line, forming an incomplete longitudinal streak.

HERPETODRYAS CARINATUS Boie, Linn.

Valley of Quito; Guayaquil; Napo and Maranon, 6706, 6682, 6661, the last all of the var. *fuscus*.

SPILOTES PICEUS Cope, sp. nov.

This species exhibits the isodont dentition and entire anal plate of *Spilotes*, 1868.]

with the cylindric body and elongate tail of *Bascanium*. The relative length of tail, within the proportions included by the genera in question, is, however, a more variable character than the integrity of the anal plate as a generic feature in our estimation. I therefore refer it to the *Spilotes* series. The divided anal plate is also characteristic of *Masticophis*, (Peters describes a Mexican species in which he says it is variable); this species is, however, more massive than these, and generally proportioned as the *Bascanium constrictor*.

Scales in fifteen rows, broad, subequal, all smooth. Tail 3.6 times into the total length. Head rather distinct, ovate, muzzle not prolonged. Anterior margin four-fifths total length; lateral margins slightly concave. Prefrontals broader than long. Occipitals concavely, continuously truncate behind; temporals 2 | 2, entirely in contact with two last labials. Only one small plate besides bounding occipital. Superior labials eight, fourth and fifth bounding orbit; sixth subtriangular, in contact with lower postocular. Postnasal higher than prenasal, loreal higher than long, one pre- two short postoculars. Inferior labials nine; postgenials considerably longer than the pregenials. The rostral plate is rather narrowed and with concave sides; it is barely visible from above.

Above and gastrosteges to one-fourth their length on each side, deep black. Lower surfaces, with upper labial shields, yellow; black margin dividing two last labials horizontally; no dark margins to labials.

Total length 51 in. 8 lin.; of tail 13 in. 8 l. Gastrosteges 169; anal 1; urosteges 92.

This fine species is from the Napo or Upper Marañon. No. 6660.

To this genus must be referred the *Geophis collaris* and *G. flaviventris* Steindachner (Sitzungsber. Wien, 1867, 271), while the name *Geophis* applied to *Coryphodon pantherinus* and *C. constrictor* of the Erp. Générale must become a synonym of *Bascanium*, Baird and Girard. *G. collaris* is *Sp. melanurus*, from Mexico, while the *G. flaviventris* is too near *Sp. corais*.

THRASOPS CUPREUS Cope, sp. nov.

A slender, cylindric species, with an unusually short broad head.

Scales in fifteen longitudinal rows, the three median a little larger than the others and equal, the median five, keeled, the keels invisible or nearly so, when the epidermis is lost. Head flat above, muzzle contracted and short. Rostral plate little visible from above, much broader than high, internasals subtriangular, behind broad as long. Prefrontal on one side descending to labials, on the other, all below the canthus rostralis cut off as a large loreal. Frontal not longer than superciliaries, with concave sides and a right angle behind. Occipitals well developed, broad, broadly truncate behind, bounded by five temporals. The anterior of these is much the largest and in contact with three labials and the postoculars; behind it a second large plate borders the last labial only. Superior labials eight, none elevated, fourth and fifth margining orbit; oculars one, two, the inferior posterior minute. The long narrow nasal is acuminate posteriorly, and borders the first and half the second labial, and the internasal plate exactly.

The number (15) of rows of scales is retained on the neck. Total length 20.5 in.; of tail 8 in.; of gape of mouth, 5.5 lines. Gastrosteges 152, anal divided (generic char.); urosteges 136.

Color above metallic copper color, with the shades at the bases of the scales, and cross-shades of the same on the anterior half of the body. A narrow dark streak from nasal plate along upper edges of labials; the latter and chin yellowish white, below brown copper colored, with darker dashes. When the epidermis is lost, which very readily occurs, the derm appears of a coppery silver color.

From the Napo and Marañon. No. 6666.

[March,

THRASOPS OCCIDENTALIS, *Ahetulla occidentalis* Günther, Proc. Zool. Soc. Lond. 1859, 412.

From Guayaquil, from Messrs. Detruger and Reeve.

OXYBELIS ACUMINATUS, Wied.

Guayaquil, 6687.

OLISTHENES CORONATUS, *Scytale coronatum*, Dum. Bibr. Gthr.

OXYRHOPUS SEBÆ, Dum. Bibr. vii, 1056.

From the valley of Quito. The stomach contained a *Liocephalus*.

LEPTOGNATHUS BUCEPHALUS Cope, *Dipsas* Schleg. *Dipsadomorus indicus* Dum. Bibr. *Dipsadomorus bucephalus* Jan. *Leptognathus indicus* Günther. Tab. Seba, xliii, 4-5.

This species is no doubt the type of Laurenti's genus *Dipsas*, as I have pointed out, (Proc. Acad. 1860) but by the rule of exclusion, as *Leptognathus* was first taken from it, the remaining species, to which Duméril and Bibron applied the name *Triglyphodon*, should retain the original name.

Fine specimen; Napo or Maranon.

As the species in the Academy are not embraced in the *Erpetologie Générale* and other works, I give a synopsis of those known to me, six of them not described in any general work. The species not embraced in the Equador collections are described at the end of the catalogue. I have been aided in this by Jan's *Elenco serpentium*.

Group I. Dorsal scales smooth, a larger vertebral series; anterior genials very short; two pairs of inferior labials in contact in advance of the genials. (*Dipsadomorus* D. B. Jan.)

Scales in 13 rows; a large preocular; above and below liver brown, with broad lighter cross bars, which terminate in a bright yellow spot on the edges of the gastrosteges; six genials, with lateral plates behind **BUCEPHALA.**

Scales in fifteen rows; no preocular; four genials; dark brown, with darker cross-bars; below yellow with lateral dark spots. **VARIEGATA.**

Group II. Scales smooth, vertebral series larger; anterior genials small, preceded by one pair of labials;

α. Loreal plate not reaching the orbit.

Two preoculars, two postoculars, scales in thirteen rows; vertebral plates reaching occipital; nine upper labials; chestnut brown, with black yellow-edged discs on the sides which become confluent into broad cross rings anteriorly, separated by yellow; head black with yellow collar and cross band on muzzle. **CATESBEYI.**

αα. Loreal plate entering the orbit.

β. Two postoculars.

Thirteen series of scales, (ten) eleven superior labials, one preocular, twelve inferiors, six genials, without laterals, vertebrals not reaching occipitals; light, a series of broad rounded, brown light edged dorsal spots, just reaching gastrosteges; belly unspotted **PAVONINA.**

Fifteen series scales, nine superior labials, no preoculars, eleven inferiors, four genials, no lateral genials, vertebrals not reaching occipitals; much compressed; yellow with broad brown entire annuli; nape and temples and spots on muzzle yellow. **ARTICULATA.**

1868.]

- Fifteen series scales, seven superior, nine inferior labials; two, one, or no preocular; six genials, with laterals, vertebrals broader, body shorter; brown, with continuous or alternate narrow, dark brown yellow-edged cross bars; belly with few lateral spots, top of head with five dark light-edged ocelli..... **MIKANII.**
- Fifteen series scales, vertebral little larger; seven superior, eleven inferior labials; six genials, no laterals; less compressed; yellow, black specked, with broad black equal annuli, not quite complete, on the belly, and dorsal black spot between; head black, varied above, belly much black spotted..... **ORNAS.**
- ββ.* Three or four postoculars.
- Vertebral series larger, no preoculars; ten superior and inferior labials, six genials with laterals; fifteen rows scales; light brown with a series of blackish cross bands, very broad anteriorly, much narrower and more numerous on most of the length; a series of brown spots below..... **INAEQUIFASCIATA.**
- Group III. Scales smooth, vertebral series larger; anterior genials forming a long pair as in other serpents, preceded by one pair labials. (*Petalognathus* D. B.)
- Fifteen rows scales, dorsal series not reaching occipitals; no preoculars, two postoculars; four genials, no laterals; thickly brown dusted, with brown yellow-edged dorsal cross bars which are or are not continuous with a lateral series which is continued on a portion of the gastrosteges; below yellow..... **NEBULATA.**
- Group IV. Scales smooth, dorsal series not larger; anterior genials elongate, colubriiform, preceded by one pair of labials.
- Thirteen rows of scales, no pre-, two postoculars; seven superior, eight inferior labials; three pairs genials, without laterals; black with yellow rings continuous on the belly but not on the anterior parts above; yellow scales black edged; temple and nape yellow..... **ANTHRACOPS.**
- Group V. Scales equal, smooth; genials short, broad, preceded by two pairs of labials.
- Fifteen rows scales, one preocular and a subloreal, three postoculars, nine superior, eleven inferior labials; slender, compressed; black with narrow yellow annuli; chin all black, a yellow collar..... **BREVIFACIES.**
- Group VI. Scales equal, smooth; genials short, broad, preceded by one pair inferior labials.
- Form little compressed, scales in fifteen rows; eleven superior, eight inferior labials; no preoculars, two postoculars; four genials without laterals; yellow brown, with three rows black, yellow edged subquadrate spots, which unite in front and become also longer; head spotted, small spots on sides of belly..... **TURGIDA.**
- Group VII. Scales equal, several dorsal series keeled; first pair of genial plates short, preceded by one pair of labials only. (*Tropidodipsas* Gthr.)
- Head more elongate, scales in seventeen rows; two anterior, two posterior oculars; three pairs genials, seven upper

[March,

- labials; black with nearly equal yellow annuli; not complete on belly..... FASCIATA.
- Head short, broad; scales in seventeen rows, the three median only keeled; one preocular, loreal reaching orbit, two postoculars, three pairs genials; six superior, nine inferior labials; black with narrow yellow rings, yellow scales, black tipped..... SARTORII.

The seven groups of this genus do not represent genera, but rather sections, for the following reasons. The vertebral series of dorsal scales is so reduced in *L. oreas* Cope, as to constitute it a link between the two types in this respect. The keels are so weak in *L. sartorii* Cope, and the allied *L. anthracops* Cope being smooth, this character appears to have no more than specific value. The elongate pregenials, appear to constitute a strong distinction, but in one of our numerous *L. nebulata* they are divided as in other species. Lastly, the peculiarity of the junction of two inferior labials is less to be relied on, in view of the fact that in one of our *L. bucephala* there is one on one side and two on the other in front of the genials.

LEPTOGNATHUS CATESBYI Günther, *Coluber* Weigel, *Stremmatognathus* D. B.
Apparently abundant on the Napo and Upper Marañon.

LEPTOGNATHUS OREAS Cope, sp. nov.

Body less compressed posteriorly than anteriorly. Frontal plate broader than long, very obtuse behind. Occipitals 1.75 times longer, narrowed and divergent behind. Temporals one large anterior higher than long, in contact with both postoculars; two broad ones, lower joining last labial, then a row of four. Four anterior labials not narrowed, third, fourth and fifth entering the orbit; the three last longer than high.

Dorsal band wider anteriorly, approaching on the sides; behind they are not all continuous, but alternate on the sides, then also the light intervals are much obscured, no black collar. Chin and throat yellow. An irregular black yellow edged band on each side of head from behind occipitals to middle of superciliaries; other head plates with similar black margins. Upper labials yellowish, with a black line from loreal plate, one from orbit, and a broad one over last labial, including two last lower labials. Belly largely obscured with black.

Gastrosteges 180, anal 1; urosteges 90.

Total length 26 in.; of tail 7 in.; of gape of mouth 8 lines.

From the elevated valley of Quito. (No. 6707.)

LEPTOGNATHUS NEBULATA Günther, Jan. *Coluber* Linn. *Dipsas* Schleg. *Petalognathus* Dum. Bibr.

No. 6708 from the valley of Quito.

This species is the most extensively distributed of the genus. It ranges from the Tierra Caliente of Vera Cruz (Sumichrast) to Nicaragua (Caldwell) to Caraccas (Ashmead) and Dutch Guiana (Hering); according to Günther from Pernambuco.

HIMANTODES CENCHOA L., D. and B.

Napo and Marañon. No. 6670.

LEPTODIRA ANNULATA Linn., Fitz.

Napo and Marañon, and Guayaquil.

PROTEROGLYPHA.

PELAMIS BICOLOR.

From Guayaquil and Panama, apparently not rare.

ELAPS LEMNISCATUS Linn.

Guayaquil, (6685.)

1868.]

ELAPS MIPARTITUS Dum. Bibr.

Four specimens from Guayaquil, and one from the valley of Quito.

ELAPS IMPERATOR Cope, sp. nov.

This is a species of the *E. corallinus* group, and is nearest to the series B. II. a. γ. αα. of Günther's synopsis of individuals of this genus;* or to the *E. ornaticornis* of Jan. It differs from the latter and from all others, in that the black bands are wider than the red and cease at the third row of scales, not extending on the first two, or on the gastroteges. The two rows are margined with black on a yellow ground. Black bands 7-5, red ones 5 scales wide; scales in the latter, of the first row, narrowly, of the two following broadly tipped with black; the remaining dorsal series entirely black or with a faint basal shade of red. Yellow margins on half scales alternating. The red bands cross the belly on two and a half gastroteges. Top of head and nape black, except outer half of internasal and prefrontal plates, which with the labials are yellow. Labials black edged, not in contact with temporals, which are yellow edged at bases. Lower lip, rostral plate, chin and belly unspotted, yellow. Two postoculars, Gastroteges 225, anal 1 | 1: urosteges 37.

Total length 2 ft. 3 in. 4 lin.; of tail 2 in. 7 l.

From the Napo and Marañon; one specimen.

It is difficult to imagine a more elegantly colored species of this beautiful, but venomous genus. Dr. Günther has shown the inconstancy of colors in some species of the genus. Within certain limits the species are very constant, as I have had occasion to observe in numerous specimens of *E. lemniscatus*, *E. elegans*, *E. mipartitus*, *E. nigrocinctus*, *E. euryxanthus*, *E. fulvius*, etc.

SOLENOGLYPHA.

TELEURASPIS NITIDA Cope. *Lachesis nitida* Günther, Proc. Zool. Lond., 1859.
From Guayaquil.

TRIGONOCEPHALUS BRASILIENSIS. *Bothrops jararaca* Wagl. *Craspedocephalus* Gray.

Three specimens from Napo and Upper Amazon; the smallest with fifteen urosteges behind the vent, undivided.

TRIGONOCEPHALUS XANTHOGRAMMUS Cope, sp. nov.

Form rather elongate; head elongate, muzzle short. Scales of body in twenty-seven longitudinal series, not strongly keeled, the dorsal narrow, those of the first row ovate, longer than broad. Scales of the whole top of the head small, smooth, nine or ten rows between the large superciliary shields. Four elongate plates in a row on top of the end of the muzzle, which are bounded behind by four much smaller ovate ones. Superior labials seven, the second bounding the pit anteriorly; the last five large and of nearly equal size, inferior labials eleven, the two anterior broadly in contact in front of geneials. Two preoculars are loreal, two nasals; rostral elevated. Gastroteges 196, urosteges 54.

Color above very dark olive, with a zigzag yellow line on each side from the head to the origin of the tail, the apices of the open Vs usually meeting on the vertebral line, enclosing dorsal rhombic spaces and lateral triangles. The bases of the triangles embrace seven or eight transverse series of scales. Gastroteges black, paler medially, with yellow irregular spots at their extremities. Gular region, chin, and superior labials bright yellow; a bright golden band round the end of the muzzle, involving the greater part of the superciliary plates, passes to the nape, and is bounded below by a black band from eye to angle of mouth; top of head black, with a pair of undulating yellow bands from the nape which meet on the vertex forming a V.

* Ann. Magaz. N. Hist., 1859, 171.

| | Inches. |
|--|---------|
| Total length..... | 60·7 |
| Length of rectus oris | 1·75 |
| Length of tail..... | 7·5 |
| Width between outer margins superciliary plates..... | 0·7 |
| From Pallatanga, Equador. Two specimens. | |

BATRACHIA.

ANURA.

ARCIFERA.

CINCLIDIUM GRANULATUM Cope, Journ. Acad. Nat. Sci., 1867, 202.

Length body and hind limb together 8·5 inches. One specimen. No. 6659.

From the Napo or Upper Amazon.

HYLA MARMORATA Daudin, Dum. Bibr.

This species is quite distinct from that described and figured under this name by Burmeister.* The latter being without name may be called *H. senicula*.

I append a description of the fresh coloration of this species, which does not appear to have been recorded.

Ground color above gray, with two large blackish blotches which extend backwards on the sides, one from the iliac, and one at the axillar regions. These are confluent on the middle line of the back, leaving only the scapular regions and insignificant spots of the ground, which is more or less replaced by bay. The last color forms a V-shaped figure with broad black border, whose limbs reach the orbits and enclose a pink gray space which is bounded in front by a black interorbital cross-band. Top of muzzle light bay. Gular region pale, with dark gray speckles. Belly and femora, except a narrow band above, with basal part of humerus, yellow black spotted; the spots smaller and thicker on the belly. Upper surfaces of limbs dark gray with rufous shades, cross-barred with darker. End of humerus and femur, fore arm and band with tibia and whole foot black below; the distal halves of the webs yellow. Dermal margin of ulna and tibia white.

From the Rio Napo or Upper Amazon below its mouth. Eleven specimens. This species is strikingly different from others of this genus, in the great extent of its webs, and the singular coloration. It appears to be abundant in the region named. No. 6649.

HYLA LEUCOPHYLLATA Beireis. *H. frontalis* Daud.

A variety in which the brown dorsal patch does not bifurcate to the lateral band, and the muzzle is rather more elongate.

Napo and Upper Maranon. No. 6650.

HYLELLA CARNEA Cope, sp. nov.

This is a small species with a broad rounded head, and slender body and limbs. The canthus rostralis is moderately distinct, and the tympanum indistinct and small, and surmounted by a fold. Eyes large and prominent, diameter ·25 greater than length of muzzle in advance of them. Nostrils terminal, end of muzzle vertical. Tongue round, ·25 free behind. Ostia pharyngea equal inner nares. Fingers ·33 webbed, and with dermal margins; dilatations of moderate size. Skin of body above smooth.

The exterior coloration does not appear on the femur, which is unicolor behind, and only as a faint line on humerus. This pigment is light rose yellow; three narrow bands across tibia, two across fore arm. A broad blood-red band between the eyes, each extremity sending a blood-red band on each side the back to the vent, with a connecting spot of the same on the coccyx. A deep

* In Erlaut. z. Naturg. Brasilens.

red band from scapular region to end of muzzle; and line below the eye. Below uniform whitish.

| | Lin. | | Lin. |
|---------------------------|------|------------------|------|
| Length head and body..... | 9 | Width head..... | 3 |
| " hind limb..... | 14 | Length gape..... | 2 |
| " hind foot..... | 6 | | |

From the Napo or Upper Marañon, (6728.)

The third species of this little known genus.

PITHECOPUS TOMOPTERNUS Cope, sp. nov.

This genus with *Agalychnis* Cope, and *Phyllomedusa*, embrace the most brilliantly colored of tropical Batrachians. Their characters were first pointed out by the writer in *Journal Ac. Nat. Sci. Phila.* 1866. The species of *Pithecopus* Cope, are now four, two having been added by the William's College Expedition; they may be distinguished as follows:

I. Parotoid stratum of crypts not visible externally; no external surface pigment on humerus.

a. A yellow band round upper lip to middle of sides; pigment of fore arm extending on two outer fingers; dilatations small; second toe shorter than inner.

No dermal processes on heel; lower eyelid transparent; no vomerine teeth; concealed portions of limbs and sides with vertical brown bands; small.....*P. AZUREUS* Cope.

No dermal processes on heel; lower eyelid reticulate; vomerine teeth; concealed surfaces of limbs with vertical brown bands; fewer of the same on sides, and brown spots behind axilla; small....*P. HYPOCHODRIALIS* Daudin.

aa. No yellow band on upper or lower lip or side; external pigment not extending on outer fingers; dilatations large, second toe longer than inner.

Lower eyelid reticulate; vomerine teeth; two angular dermal heel processes, together having a truncate posterior outline; concealed surfaces brilliant yellow, with broad vertical purple bars; size larger—

P. TOMOPTERNUS Cope.

II. Parotoid stratum of crypts distinct, extending from orbit to sacrum; humerus covered with the external pigment.

a. No yellow band on upper lip, an imperfect one on side; outer fingers and toes covered with the external pigment; dilatations large, second toe shorter than inner.

No dermal processes; lower eyelid not reticulate; vomerine teeth present; green, upper arm with a yellow band; concealed surfaces of limbs with purple clouds; below purplish; large.....*P. TARSIS* Cope.

P. tomopternus has much the coloration of *Agalychnis* sp., and the whole form a series leading from *Hyla* to *Phyllomedusa*.* The *P. tarsis* ap-

* One species of this genus has been long known, but has been confounded by modern authors with the longest known species of the genus *Pithecopus*. A second species is here added.

Inner toes equal; dilatations large; sides little, limbs unspotted; skin with stellate bony deposits..... scleroderma.
Second toe shorter than first; dilatations small; sides, throat and limbs largely yellow-spotted; skin smooth..... bicolor.

P. SCLERODERMA sp. nov.

One of the largest of the *Hylidae*, measuring from end of muzzle to vent 4 in. 1½ lines, same to posterior border tympanum 1 in. 3¼ l.; between parotoids and scapula 1 in. 6½ l. Axilla to carpus 1 in. 11½ l. Carpus to end of third finger 1 in. 2½ l. Femur and tibia 3 in. 0½ l.; tarsus 1 in. 3 l.; tarsus to end fourth toe 1 in. 4½ l.

The general form is much that of *P. bicolor*, but the toes are longer and provided with larger dilatations; the under face of the tarsus, and the skin generally, are devoid of dermal tubercles. The integument of the whole upper surface of the head and body is studded with aggregations of osseous radil, which surround, more or less, numerous

[March,

proaches the last named genus most closely, and equals them in size. Of the *P. azureus* I have seen three specimens from Brazil, two from the upper Paraguay, and one from Pernambuco; of the *P. hypochondrialis* one specimen from Dutch Guiana.

The *P. tomopternus* is of elongate form; width of head 3.3 times from end of muzzle to end coccyx. Loreal region elevated, plane, canthus rostralis contracted, muzzle not quite vertical in profile. Tympanum one-third the large eye. Vomerine in two small fascicles opposite the anterior part of inner nares, as far apart as each is from the choana. Inner nares very large, rather larger than ostia of eustachian tube. The elbow reaches end of muzzle, the heel to front of orbit. A dermal fold on lower arm, strong on elbow; a weak one on tarsus, terminating above in two heel processes, one projecting inwards and one outwards. All the fingers and toes entirely free, thumb opposable, fourth finger considerably longer than second. Longest toe the fourth, then 5, 3, 2, 1. Palm and sole with strong tubercles.

The colors are very brilliant; above green, below with hands and feet yellow; outer fingers and toes bound with purple, like the concealed surfaces. One specimen has an exceedingly narrow yellow margin to the upper lip. No brown margin inside lower lip.

| | Lines. |
|--|--------|
| Total length head and body..... | 23· |
| Length to posterior margin tympanum (axial)..... | 6·1 |
| “ fore limb..... | 15·6 |
| “ hand..... | 5·6 |
| “ hind limb from groin..... | 32·6 |
| “ tarsus..... | 7·75 |
| “ metatarsus and longest toe..... | 7· |

Two specimens of this tree-frog are in the collection from the Rio Napo, Upper Amazon, below the mouth of the former. They are males and have the corneous thumb shield of the breeding season. No. 6651, Mus. Smiths.

PITHECOPUS TARSIS Cope, sp. nov.

Form slender; width of head at jaws, enters from end nose to vent, 3.5 times. Loreal region elevated, with the canthus concave; upper lip projecting beyond muzzle. Diameter of eye three times tympanum. Tongue elongate, largely free and openly marginate behind, narrowed in front. Vomerine teeth in two transverse fasciculi, which are equi-distant from each other and the anterior margin of the large internal nares. Ostia large and less than nares. Skin everywhere granular, perhaps more properly glandular, those of the sides largest. Areolæ very large and flat on the pectoral region; a series of larger glandulous areolæ on each thigh below. No distinct dermal margin on forearm or tarsus. Digital dilatations of hand largest, larger than the tympanic disc; that of the thumb smaller. Elbow to opposite nares; heel to front of orbit. Second toe much shorter than first, third less than fifth.

Color everywhere green, shaded with purple on gular and thoracic regions; also along sides and on under surfaces of thumbs. Femur green, except below, two external digits of the same color. An irregular yellow band on side from

central points. These do not penetrate through the derm, which is thick, and entirely free from the skeleton in every part. Muzzle elevated, loreal region straight, canthus rostralis strong, concave. Male with vocal vesicle. Tympanum one-half of orbit; inferior palpebra medially transparent, dermoid at the circumference. Vomerine fasciculi oblique between nares as near the latter as each other. Minute areolations on posterior gular region. Tongue small. Elbow extends to end of muzzle; hand and longest finger equal forearm. Heel to orbit; sole and longest toe exceeding tarsus; cuneiform tubercle minute; base of thumb broad, with a flattened tubercle.

Blue-green with faint light margin to posterior parts of upper and lower lips, and one series of very narrow longitudinal lateral spots. Limbs blue above, except the pale brown spotted upper arm; antebrachium and tarsus yellow margined; femora uniform pale blue behind. Below uniform pale.

Habitat.—Surinam, Hering, Mus. Academy Nat. Sciences. Burmeister suspects the species of the Amazon to be that found in Surinam, and different from the *P. bicolor*.

1868.]

angle of mouth and margin of mandible. Two isolated yellow spots on breast, and one on each side the vent below.

| | In. | Lin. |
|--|-----|------|
| Length head and body..... | 3 | 9-25 |
| “ head, axially, to line tympanum..... | 1 | |
| “ fore limb..... | 2 | 8- |
| “ hand..... | 1 | 1 |
| “ hind limb from groin..... | 5 | 3- |
| “ tarsus..... | 1 | 4-15 |
| “ remainder of foot..... | 1 | 2-25 |

This tree-frog, it is to be observed, exceeds the *Phyllomedusa bicolor* in size. One male with the file-like corneous plates on the metatarsus of the thumb is in the collection, from the same locality as the last. No. 6652, Mus. Smithsonian.

HEMIPHRACTUS DIVARICATUS Cope, sp. nov.

A single specimen of this species has afforded the first opportunity of investigating the structure of this genus. The result convinces me of the propriety of recognizing in it a peculiar family as Peters has done, and confirming entirely the position I assigned it in the essay on genera of *Arcifera*.* The form of the distal phalanges is a compromise between that of many aquatic frogs and that of the *Hylidæ*, the proximal globe being not recognizable, and much flattened. Its structure is different from that of *Hylodes*, though it does not probably inhabit trees any more than that genus, or *Chorophilus* and *Acris* among true *Hylidæ*.

The coracoid and epicoracoid are much less divergent than in other families, and the arched cartilages are very wide, overlapping more extensively than in any genus I am acquainted with.

The *H. divaricatus* is nearer the *H. scutatus* than to the *H. fasciatus*. It differs from the latter chiefly in the form and proportions of the helmet; this is shorter and broader, with more divergent outlines, and is plane and flat behind, and not so convex; it lacks the recurved margin represented by Peters. In profile the upper margin of the mouth is straight, not curved, and the eye is median, not anterior. Other differences are that the anterior vomerine tooth, or teeth, are abruptly longer than the others, and the throat is blackish, with a broad yellow median band. There are transverse rows of tubercles on the sides of the belly.

Interorbital width about one-third expanse of supratympanic ridges; from end muzzle to interorbital point 1.5 times from latter to concavity of posterior margin helmet. From bony orbit to tympanum equal from latter to angle of helmet.

Orbital fissure .75 long (vertical), diameter membranum tympani, which latter is double width of same. Margin of helmet behind, medially slightly elevated. Muzzle flat with a short terminal dermal process; eyelids with a marginal prolongation. Head slightly granular above; body smooth above; oblique rows of tubercles on forearm. Belly closely, throat sparsely, granular. Both fingers and toes with rudimental web. A large palmar tubercle; two indistinct metatarsal tubercles, the inner elongate. A fold along tarsus and outer toe; slight dermal margins on all the toes. A similar fold on forearm and outer finger, and on the other fingers.

| | In. | Lin. |
|--|-----|-------|
| Length head and body to vent | 2 | 2- |
| “ of casque on mediad line; least..... | | 10-5 |
| “ “ “ “ greatest | | 13-25 |
| “ hind limb..... | 2 | 11-5 |
| “ foot..... | 1 | 4-5 |
| “ tarsus..... | | 7- |

* Journal Academy, 1866.

| | | |
|--------------------------------------|---|-----|
| Length forelimb..... | 1 | 3· |
| " hand | | 7·5 |
| Width between nares | | 1·6 |
| " orbits | | 5· |
| " casque, superiorly, behind..... | | 14· |
| " " inferiorly, " | | 16· |

Grayish-brown above, dark-brown below; a yellow band from chin to breast; black bands on tarsus and forearm. A black blotch below vent, one above tympanum, one below eye (indistinct on one side), and several smaller ones on edge of upper lip.

From the Napo and Maranon. 6648.

Two specimens of two species of this genus in the Museum of Munich are the only ones known in any Museum besides the present one.

The curious and high degree of ossification of the crania of this and several other Neotropical genera, appears to be a defence to the animals possessing it. When killed in spirits they frequently die with the flexor muscles of the head contracted, and the bony front presented like a shield. This is no doubt an important defense against the bite of venomous serpents, which abound in the regions where they occur. This defence appears, however, to be rather a consequence of such structure than a cause, in a physiological sense; since the majority of the Anura in the Continental Neotropical region, where they are equally exposed to venomous serpents, do not possess it, while the tree-toads of the West Indian district, where venomous snakes are almost unknown, invariably exhibit this extraordinary ossification.

LITHODYTES CONSPICILLATUS. *Hylodes conspicillatus* Günther, Br. Z. S. Lond. 1859.

From the valley of Quito.

CYSTIGNATHUS HYLÆDACTYLUS Cope, sp. nov.

A species belonging to the section of the genus characterized by having the vomerine teeth in two arched series on the line of the palatine bones; the digits without dermal margins, and the belly included in a discoid fold of the derm.

A vertebral and dorso-lateral dermal fold, and some shorter ones on the sides, but no large warts or glands on the groin. Muzzle ovate, gradually descending at extremity, canthus rostralis not strong, contracted. Tibia less than half head and body. Ethmoid not ossified to end muzzle. Brown with a dark-brown band at each dorso-lateral fold, and two dark spots on the anterior half of each side. A dark band from axilla to orbit, from orbit to tip, and between orbits. Fore limbs not, hind limbs scarcely cross-barred; femur marbled behind. Belly and throat pale yellow.

The toes have distinct dilatations at the end, but not the fingers; all have strong tubercles below; two minute metatarsal tubercles. Tongue considerably free behind and laterally. Vomerine series not extending exterior to inner margin of nares. Tympanum one-half orbit. Wrist not quite to end muzzle; heel to middle of orbit.

Total length 11·6 l.; of hind limb 16·1 l.; of gape 3·1 l.; width head behind 4· lines.

From the Napo or upper Maranon.

In spite of its dilated toes this is a true *Cystignathus*. I also place in this genus *Hylodes hallowellii* Cope, and *Platymantis petersii* Steindachner. They are closely allied to each other; the latter by no means a (*Platymantis*) *Halophila*, a genus which does not occur in the new world.

BUFO NARICUS Spix.

From the Napo and Maranon.

BUFO ANDIANUS Cope. "*Bufo intermedius* Gthr.," Cope, Proc. Ac. N. Sci. Phil. 1862, 376, nec *Guentherii*, hinc *Phrynoidis intermedius* Cope, l. c.

1868.]

Cranium with the curved orbital margin elevated into a ridge, and continued into a strong supratympanic ridge; a short preorbital ridge, no postorbital. Parotoid gland divergent towards the sides, elongate triangular narrow, continued into a lateral dermal fold. Two metatarsal tubercles, both small; a smooth-edged tarsal fold. Tympanum distinct, less than half diameter of eye. A trace of a parietal branch ridge on cranium. Canthus rostralis very strong, concave short. Muzzle elevated, profile vertical, not as long, in a straight line, as the long diameter of eye fissure. Nostril terminal. Greatest width of head 2.6 times in length head and body; length foot without tarsus 2.75 in same. Hind foot, outer toes with last phalanges only free; $3\frac{1}{2}$ of median free. Heel to hinder edge orbit. Skin covered with small round tubercles above. Palms and soles rough, and limbs generally, metacarpus with two strong tubercles. Half the femur included in the skin of the body.

Gray above, with small paired dark-brown spot on each side the median line; these are more or less confluent, and have a few smaller spots external to them. Sides below lateral fold brown-marbled. Lip with two brown spots on each side, a large brown spot on each side tympanum. A brown band across eyelid and vertex. Pale below, with brown blotches on breast and belly.

| | Lln. | | Lln. |
|-----------------------------------|------|---------------------|------|
| Length head and body | 19.5 | Length tarsus..... | 4.5 |
| " " includ. tympanum... 5.4 | | " long toe..... | 7.5 |
| " tibia. | 7.4 | " hind limb..... | 23. |

Several specimens (No. 6712) from the valley of Quito. Originally brought from Carthage, New Grenada. (No. 4350 Mus. Smithsonian.)

This species is nearest the *B. agua*. It differs in its very much smaller size, being one-eighth or tenth the bulk of the latter, in its relatively smaller and narrower parotoid glands, and in its pinched, narrow, angulate muzzle. It is also near the *B. diptychus* Cope, a still smaller species. In the latter the toes are much less palmate, the muzzle longer and the parotoids broader.

BUFO AGUA Daud. *B. marinus* Schneider.

From the Napo and Upper Amazon.

RANIFORMIA.

Ateolopus longirostris Cope, sp. nov.

The muzzle prolonged, the ethmoid cartilage overhanging the labial border, and forming an acute-angled prominence. The muzzle a little longer than the long diameter of the eye ball; nostril just behind a lateral projection formed by the extremity of the prefrontal. Canthus nostralis a right angle, lores nearly plane, upper profile entirely plane, transversely a little concave in front of the orbits. Greatest width of head behind nearly one-third length from end muzzle to end coccyx. Extended backwards the fore limb extends beyond the vent; forward the hind limb measures to the front of the orbit with the heel. Toes about half webbed, the inner quite rudimentary; fingers slightly webbed, the inner short. Skin above and below entirely smooth, a line of granular elevations along the side. A faint tarsal fold; metatarsal tubercles not developed. Ostia of eustachian tubes, each half an inner nostril; latter small lateral. Tongue narrow, elongate. One large round metacarpal tubercle. Total length 10.6 lines. From nostril to posterior extremity supratympanic ridge 3.3 lines. Total length fore limb 6.6 lines; of hind do. 13.1 lines; foot 6 lines; tarsus 3.5 lines; extent of sacrum 3 lines.

Above black; under surfaces and upper lip yellow. A greenish spot on each scapular region, and two or three pairs of the same on each side the vertebral line. Femur behind yellow, with a proximal longitudinal, and two distal transverse black bands. All the toes blackish, thumb yellow.

From the valley of Quito.

[March,

This species is in general appearance somewhat similar to the *A. varius*, from Central America, but that has a relatively longer body and shorter limbs and head, and lacks the singular nasal appendage. In this species the clavicles and coracoids are considerably more divergent. It constitutes among *Atelopodes*, an approximation to *Rhinoderma*.

In the writer's examination of the Families of Raniform Anura* the genera *Atelopus* and *Phrynidium* were accidentally retained as distinct, as was done by Günther, the fact having been lost sight of while correcting the proofs that Peters had shown them to be identical in the structure of the auditory apparatus. I do not think it probable that they should be retained as distinct on account of the remarkable difference in the degree of ossification of the ethmoid, which I have there pointed out.

The structure of the sternum in *Atelopus longirostris* throws much light on that of the genus *Hemissus*, discussed in the essay above quoted. The latter genus ought probably to have been compared with *Phrynisca* rather than *Engystoumide*. I have already shown† that the clavical and coracoid are not in contact in *Atelopus*, but are connected by a simple longitudinal cartilage. This is the structure in all the *Phrynisca* I have examined, and is quite different from the truly Raniform character of the *Dendrobatidæ* and *Colostelthidæ*. This elongation of the confluent epicoracoid cartilages—for such is its homology—reaches its greatest extent in the family, in *Atelopus longirostris*, making a distant approach to what is probably the condition in *Hemissus*. The anterior transverse element of the latter genus is therefore probably rather clavicle than coracoid, as suggested above.

Ateopus lævis Cope. *Phrynicus lævis* Gthr. Catal. B. M.

From the valley of Quito.

Ranula affinis ? *Rana affinis* Peters, Monatsberichte, Berlin Acad.

This may be Peter's species, though the latter is so briefly described that it is not readily identified. Having examined the type in Berlin, I am not prepared to agree with its learned describer that it is a climatal variety of *Rana temporaria*.

Dr. Steindachner recognizes this genus,‡ but renames it *Pohlia*, and gives it a character of cartilaginous "Stirnbeine" in front, rather than cartilaginous ethmoid.

The genus *Ranula* turns out to have simple terminal phalanges as in *Rana*, therefore three of the species formerly assigned to it by me, which have T-shaped phalanges must be regarded as belonging to another and unnamed genus. This I call *TRYPHNEROPSIS* and refer to *T. chrysoprasinus* m. as the type. It represents the *Hylarana* of the Old World, and bears the same relation to *Ranula* that the former does to *Rana*.

Size and form that of *Rana clamitans*, but with small membranum tympani—equal to orbit, and 1.5 length of muzzle. Toes palmate to near end of last phalange, to basis of the same of longest toe. Head plane above, fronto-parietals broad without posterior crests, equal between orbits the length of ethmoid cartilage. Canthus rostralis sharp, loreal region concave; muzzle truncate in profile. Prefrontal bones three times as long as wide. Vomerine teeth in two small fasciculi, exactly between inner nares, nearer to each other than to the latter. Nares considerably less than ostia pharyngea. Outer nostrils half as far from end of muzzle as from orbit. Skin everywhere smooth, except a few minute granulations on posterior pelvic region. Fingers elongate, the inner longer than the second, all with a narrow dermal margin. When extended, the bases of the metacarpals mark the end of the muzzle. The hind limbs extended, nearly measure to the end of the muzzle with the heel.

* Journ. Ac. Nat. Sci. 1867, 189.

† Nat. Hist. Review, 1865.

‡ Characterized Proc. Academy, 1868, 129.

Length of head (to opposite hinder margin tympanum) 14 | 5 times in length, vent equal width of head behind.

| | In. | Lin. |
|----------------------------|-----|------|
| Length head and body | 2 | 6.5 |
| “ of muzzle to orbit. | | 4.6 |
| “ of fore limb..... | 1 | 6 |
| “ of hand | | 8 |
| “ of hind limb..... | 3 | 11.5 |
| “ of foot | 1 | 10 |
| “ of tarsus..... | | 8 |

Color above light olive, with a few small black spots on the pelvic region. A black line on canthus rostralis on edge of upper lip and one round tympanum. Femur and tibia each with two narrow black cross bands. Numerous black spots on groin and front of femur. Femur and tibia behind closely marbled with deep black. Tarsus and forearm black below. An indistinct yellow band from nostril to axilla.

Two specimens from the Napo or Upper Marañon.

This species differs from the *R. palmipes* of Spix, according to the complete description of Steindachner in having a considerably shorter and more truncate muzzle. In the last named the nostril is equidistant between muzzle and orbit, and the diameter of the latter is one half the same distance; in this species it is two-thirds. Our species has the thumb longer, and the black marbling of the femoral regions is probably characteristic, as Steindachner does not mention it.

How it differs from the *R. affinis* (*Rana* Peters) the description of the latter author does not furnish the means of determining. The latter has the same obtuse muzzle.

GYMNOPHIDIA.

CÆCILIA PACHYNEMA Günther, Proc. Zool. Soc London, 1859.

Two specimens from Guayaquil. They have 170—180 annuli respectively. In the larger the eyes are distinct; there are eight teeth on each side the upper and six on each side the lower jaw, with five vomero-palatines on each side. In the smaller specimen the eyes are invisible; in both the narial valvules are present on the tongue. Günther did not find these, nor eyes, and counted only 5 | 3 | 3 teeth. He describes blue spots on the sides; these are accidental and dependent on the condition of the integument.

SIPHONOPS ANNULATUS Dum. Bibron.

From Lower Napo or Amazon.

The whole number of species brought by the Expedition is:

| | | | |
|------------------|----|----------------|----|
| Crocodylia..... | 1 | Ophidia | 34 |
| Testudinata..... | 3 | Batrachia..... | 16 |
| Sauria..... | 19 | | |
| | | Total..... | 73 |

These are from three distinct faunal districts—those of the Western Coast, the Table land of Quito, and of the Eastern Slope of the Andes. The number of species found in each is as follows:

| | |
|-----------------|----|
| Western..... | 27 |
| Table Land..... | 16 |
| Eastern..... | 44 |

In the Western district are five species which occur in Brazil, and one (*Chelydra*) which extends from Mexico to the cold regions of North America. Two species of the same list occur in Middle Mexico. Of the species from near Quito, four occur in the Western List, and four also found in Eastern Brazil; one is common in Middle Mexico. Of the species of the Eastern list, the Sauria were chiefly obtained from points within the limits of Ecuador, and the Ophidia from near the Brazilian frontier. Of the last, twelve are also

[March,

Eastern Brazilian; of the first, and Batrachia, seven are found in the latter region.

Of generic types none of any extent appear to be restricted to either of the Western regions. *Trachyboa* with one species does not probably occur out of the West Coast region. *Euspondylus*, so far as known, is confined to the elevated regions and the adjoining Eastern and Western Slopes. *Teleuraspis* is largely developed in Central America and *Coniophanes* in Mexico. Of the genera of the Eastern district, *Centropyx*, *Teius*, *Hypsibatus*, *Hyla*, *Pithecopus*, *Hypsiobas*, *Ranula*, *Himantodes*, *Olisthenes* and *Typhlops*, have not been brought either from the Table Land or the Western district. The absence of *Hyla* has been already noted by Günther.

The sources of information respecting the cold blooded vertebrates of Ecuador are the collections of Fraser, made in the Western district, and identified and described by Günther in the Proc. Zoological Soc. London, 1859; and the collections of the Prussian Consul Reiss, published from time to time by Peters in the Monatsberichte of the Berlin Academy.

Fraser procured forty-nine species; to this number Peters added four, and the present enumeration four. The new species of the present list are mostly from the Table Land and Eastern region, and number twenty-four.

Additional descriptions of Neotropical Reptilia and Batrachia not previously known.

TESTUDINATA.

DERMATEMYS Gray.

This genus presents a peculiarity of the skeleton which has never been noticed. This is, that the vertebral elements of the carapace are not prolonged to the posterior marginal bones as in *Emydidae** but terminate so as to allow of three costæ uniting in a median dorsal suture. This character has heretofore been supposed to characterize the *Cinosternidae*, which also lack the mesosternal bone. In this genus the mesosternal is well developed. *Cistudo* has, however, the last pair of costal bones joined by suture, and in the same family. *Claudius* Cope, is another genus possessing the same character. It is a character also of the genus *Hydraspis*.

The genus *Pelomedusa* Wagler I have shown† to possess only two series of phalanges instead of the usual number, three. It is on this account as separate from the other *Pleurodira*, as *Testudo* is from the remainder of the *Cryptodira*. On this ground I consider it to represent a family hitherto unnoticed—the *Pelomedusidae*.

Sternothærus Bell possesses an important structure hitherto unobserved. As in the extinct genus *Pleurosternum*; the hyosternal bones are divided transversely, giving ten bones to the plastron instead of eight. It therefore represents a family which I call the *Sternothæridæ*, representing among the *Pleurodira* the extinct family *Pleurosternidae* among the *Cryptodira*. It may be here mentioned that I have found a fine new *Pleurosternum*—Pl. pectorale m.—in the cretaceous Green Sand of New Jersey.

The above facts confirm the supposition of Agassiz that the *Pleurodira* would be found to constitute a series of families, rather than one family.

One species of *Dermatemys*, the *D. mavei*, is recognized by Dr. Gray as inhabiting Venezuela and Mexico. The same species, according to the same author, has been subsequently named *Emys berardi* by Prof. Duméril. I have not had an opportunity of seeing South American specimens, but the excellent figure and description of Gray render it certain that the individuals from that country on which the species was based really belong to another species from those of Mexico. The collections of the Smithsonian Institution

* Agassiz states—Contrib. Nat. Hist. U. States I, that in all *Emydidæ* the vertebral series of bones is uninterrupted.

† Proc. Ac. Nat. Sci. Phila., 1865, p. 186.

furnish another species from Belize, which I have heretofore identified with the same.

The species may be thus distinguished.

- One gular scute, no intergular; five inner marginals, the posterior triangular, not in contact with the femoral or abdominal. Abdominal narrower than pectoral or femoral. Sternum little emarginate behind. Vertebral scuta broader than long, the median except behind covering a keeled ridge..... **ABNORMIS.**
- One gular, and an intergular behind it; four or five inner marginals, the posterior in contact with femoral and abdominal; when only four, the median elongate; vertebral scuta much longer than broad; no dorsal keel. Abdominal scuta equal or wider than those adjoining..... **BERARDII.**
- Two gulars, no intergular; four inner marginals, the median shorter than the hinder, joined as in the last; abdominal as in the last; vertebrals much longer than wide, no dorsal keel. Sternum well emarginate behind..... **MAYI.**

DERMATOMYS ABNORMIS Cope, sp. nov.

The greatest breadth of the vertebral plates exceeds the length of the costals; the length of the same equals the width of the anterior costals, exceeding the width of the posterior. The form of the head is elongate, and acuminate; there is a strong basal angle all round the mandible below the cutting edge. Though the carapace measures seven inches in length, the costal bones are only united for half their length, and the hyo- and hyposternal bones are entirely separated from the marginals. This lateral fontanelle is eight lines wide medially. The plastron is well developed, except a very small fontanelle at the middle of the hyo-hyposternal suture. This, with the wider vertebral shields, indicate a young animal, and though there are no signs of immaturity about the head, it doubtless is such. Nevertheless, I cannot suppose the vertebral scutes become as narrow, nor the carapace as fully ossified at maturity, as in the other species, and its distinctness is confirmed by other characters as given.

Above light brown, below and inner faces of limbs light yellow.

Length of plastron 5 in. 9 lin.; width of same at axillæ 3 in.; at posterior end 11.5 lin.; total width at groin 5 in. 5 lin.; length head from behind ear 17 l.; greatest width head 1 in.

From Belize River, Yucatan. Museum Smithsonian, No. 6545; from Dr. Parsons.

LACERTILIA.

PROCTOTRETUS Dum. Bibr.

PROCTOTRETUS PRASINUS Cope, sp. nov., of the group *Rhytidodira* Gird.

Head broad, short, vertex and front plane longitudinally and transversely. Canthus rostralis strong, loreal region concave. Nostril just below the edge of the canthus. Scales of head above smooth, angulated. A transverse scale behind rostral; a united pair of supranasals, the larger divided internasals between the smaller longitudinal posterior supranasals. Three pairs frontonasals, the two anterior in contact with canthal row, and separated by four scales; the posterior largest, and in contact. No superciliary series, except from the frontal backwards; frontal little longer than broad. Occipital (= interparietal) small, in contact with superciliary rows, and followed by two plates a little larger. Occipital and temporal regions covered with rather large, smooth scales, those of the latter smaller, and rounded behind. Supraorbitals of irregular size, smooth, the three inner larger, little broader than long; together three rows scarcely separated within by a series of small scales. Two marginal

[March,

rows. Three loreal rows, the lower continued below the suborbital. Labials 5—6; two rows infralabials, the inner shorter, of broader scales, the first pair in contact. Auricular meatus large, no marginal scales.

Scales of dorsal region small, not larger than ventral, little larger than lateral, not longer than broad, with a keel on the distal half and obtuse mucro. They are in series, which converge upwards and backwards. Sixty-nine series from rump to occiput; fourteen across the nape. A broad granular band extends from the ears to more than the length of the humerus behind the axillæ. A pair of longitudinal folds extend from above and below the meatus, and unite half-way to the axilla, to which point the single fold extends. Another extends along the side.

Lateral and abdominal scales smooth, the latter rounded, smooth, occasionally slightly notched; gulars entire; caudal scales small, in whorls, strongly keeled. Extended fore limb reaches .66 to groin; hind limb to union of side folds of neck.

| | In. | Lin. | | Lin. |
|--------------------------------|-----|------|----------------------|------|
| Total length (tail mutilated): | 5 | 11.2 | | |
| Length to vent..... | 2 | 7 | Length to orbit..... | 2.5 |
| " axilla..... | | 11.5 | Width of head..... | 5.5 |
| " meatus of ear..... | | 7 | Length of pes..... | 10 |

Color above brilliant green, with a double series of black dorsal spots, with angles projecting laterally, which posteriorly meet similar angles from a lateral series of larger deep black spots. The green continues as a band to orbit. A series of vertical black bars on sides; limbs green-black, cross-banded; tail brown-black ringed; top of head black, brown and green specked. Lower jaw black-barred. Belly light green.

From 603. Museum Comparative Zoology, Cambridge. From Chili.

LIOCEPHALUS Gray.

Having had a large number of individuals of this genus at my disposal, as the species are but little known I give the following synopsis. Gray, who gives the fullest list (Catalogue Sauria Brit. Mus. 1845), enumerates five. There are at present fourteen known.

I. Several series supraorbital scales; no transverse plates. Abdominal scales smooth.

L. ornatus Gray, Catal. *L. trachycephalus* Dum., Catal. Method. The former from Guayaquil, the latter from Bogota.

II. Transverse series of plates on the supraorbital region; abdominal scales smooth.

a. Parietals and interparietals united.

Supraorbital region scaled in front; a black spot on throat. Gallapagos Is. *L. grayi*.

aa. Parietals and interparietals distinct; the former transversely divided.

Three pairs frontonasals; three interparietals; a black spot on throat. Ecuador. *L. iridescens*.

ac. Parietals and interparietals distinct; the former longitudinally divided.

β. Four pairs frontonasals (four rows plates across front).

Outer parietals larger than inner; interparietal short, triangular; two rows scales above infralabials; tail crest high. Brown, with many light cross-bars *L. eremitus*.

$\beta\beta$. Three pairs frontonasals.

γ . Outer parietals much larger than inner.

Top of head smooth; plates of front wide; interparietal long and narrow; one row above infralabials.

Light olive. Bahamas, Cuba..... *L. carinatus*.

$\gamma\gamma$. Outer parietals narrow, equal inner.

L. vittatus Hallow. and *L. macropus* Cope, both from Cuba. *L. schreibersii* (*Pristonotus schreibersii* Gravenhorst, not *L. schreibersii* Gray = *L. vittatus*), and *L. melanochlorus* Cope, from Hayti.

$\beta\beta$. Two pairs of frontonasals.

Scales smaller; temporal scales small, keeled; of front much keeled; auricular scales elongate;

interparietal very small. Hayti..... *L. raviceps*.

Scales larger; temporals large, smooth; auriculars short, thick; scales of front little keeled. From

Hayti *L. personatus* and *L. trigeminatus*.

The last two are much alike in structural features, but differ greatly in coloration; they do not appear to be sexes of the same animal, as I have seen both ♂ and ♀ of the latter.

III. Transverse series supraorbital plates; abdominal scales keeled.

Scales on nape in 5—1—5 rows; seven supraorbitals; frontal scales many, keeled.

L. herminieri Dum. Bibr., from Martinique.

I am not acquainted with *L. macleayi* Gray, from Cuba; it is probably allied to the *L. carinatus* and *L. vittatus*.

LIOCEPHALUS EREMITUS Cope, sp. nov.

Head moderately elongate, profile an inclined plane. Front with four cross-rows of plates posterior to supranasals, the posterior smallest; two pairs of internasals, separated from each other, the anterior from the rostral also; the posterior pair of the same in line and continuous with the divided frontal. Interparietal very short, the parietals largely in contact behind, the outer twice as wide as the inner. All the scales of head smooth, except the supraorbitals. The latter weakly keeled, six on each side, separated by one row scales from supraorbitals; also by one row small scales from superciliaries. Parietals bounded externally by two rows larger scales, then minute scales, then medium keeled preauriculars. Auricular scales elongate, four. Postauriculars not granular. Scales above large, eight rows on median nuchal region. Dorsal crest high on tail, elsewhere moderate. Lateral and abdominal scales smaller than dorsal. Scales of lower surfaces entire, the preanals smaller, keeled. The muzzle marks the end of the metacarpus on the extended fore limb, and the front of the orbit the longest toe. Tail moderately compressed. Folds of side of neck strong; two oblique, one nearly horizontal. Scales of tail shiny, keeled below except at basis.

Coloration plain. Ground dark olive-brown, with a deep brown dorso-lateral longitudinal shade, connected by numerous indistinct cross-bars, which are light margined behind. Lower surfaces brown, with numerous scattered whitish scales, which are most thickly gathered on the pectoral region. A dark brown spot between eye and ear.

| | In. | Lin. |
|-------------------------------------|-----|------|
| Length from end muzzle to vent..... | 2 | 5.5 |
| " " to ear..... | | 8 |
| " of hind foot..... | | 13.5 |
| Width of head..... | | 6 |

One specimen of this species was sent to the Smithsonian Institution by W. J. Rasin, from the island of Navassa, W. I., which lies to the south-west of St. Domingo, in line with Jamaica.

[March,

LIOCEPHALUS SCHREIBERSII. *Pristonotus schreibersii* Gravenhorst, Nova Acta Curios. xviii, 739. Tab.

This species is not anywhere described in the English language. I therefore append the following, which I took from specimens in the Mus. Leyden :

Crest very long, equal ; scales longer than high, other sc. small, keels not prominent. 7—1—7 sc. on nape ; on rump, 7 or 8—1—7. Smaller lateral sc. in a not wide band. Abd. sc. in 23 rows, rhombic. Sc. from ear to shoulder granular ; tail compressed. Extended hind limb, near to ear. Interparietal narrow ; 8 supraorb. Supercil. not separated. 3 pair frontonas., the poster. often double ; 4 in the median row ; the frontonas. as broad as long. Head sc. keeled.

Olive-brown ; with or without traces of a light band on each side of back, which are most distinct on tail ; sides with a band of brown speckles. Green below, with 4 or 6 cross-bands of blue-white bordered spotlets ; obsolete anteriorly. Bluish on gular region. Head lighter, uniform ; feins with two transv. series of spots ? Fem. with 2 longit. dors. stripes, and a distinct one on lower part of each side. Transverse angulated brown bands behind white border, from side to side. A yellow band on post. face of femur. Dors. crest very small, scarcely on tail. Head sc. broad, keeled.

CELESTUS Gray.

Catal. Lizards Brit. Mus., 117.

This genus, in my opinion, embraces the *Diploglossinæ*, with normal extremities, in which the frontonasal plates are fused together in one shield ; it therefore includes most of the species of *Diploglossus*, as understood by Gray. *Diploglossus* was originally based by Wiegmann on *D. monotropis* and *D. fasciatus*, species in which the frontonasals are quite distinct. Both are from the South American continent ; the first-named is the type of *Camilia* (*C. jamaicensis*) of Gray. The correspondence of the Smithsonian Institution has procured numerous additions to this genus, which are here added :

A. Internasal plates confluent with frontonasals.

I. Scales in 32—6 rows.

Two frontals, one above the other ; two postnasals do. ; scales all 8—10 keeled ; olive, sides black-spotted, **STEINDACHNERI** Cope.

One frenal and postnasal ; scales smooth in front, keels increasing to 16 on tail ; sides and limbs black ; above olive, the scales black-edged..... **CHALYBÆUS** Cope.

Keels of the scales eight to ten ; one postnasal, two frenals, both on labials ; meatus of ear large ; anterior limb two-thirds head. Brown, with blackish band on upper part of each side..... **PLEII** Dum. Bibr.

Keels of the scales eleven, all equal, on posterior regions ; anterior scales smooth, together in 36 rows ; nasal plate extending to rostral ; two loreals, both higher than long ; ear minute, head and limbs very short, latter .75 former, and .2 from axilla to groin ; a blackish lateral band above, cross-lined before, spotted behind..... **DEGENER** Cope.

Keels of the scales fifteen, all equal ; one postnasal, two frenals, both on labials ; ear meatus small. Serpentiniform, fore limb five-sixths head. Brown, with dark lateral band above..... **SAGRÆ** Coct.

II. Scales in 41—2 rows.

Keels 14 ; none larger ; head narrow, sharp, muzzle longer than interorbital width ; front plane ; parietal separated from supraorbitals by two plates, loreal longer than high ; gray, sides black, cross-banded ; loreal higher than long ... **PHOXINUS** Cope.

- Keels 15, a median stronger; front convex; distance between orbits in front equal length muzzle; both loreals higher than long; one plate between parietal and supraorbitals; brown, a deep brown dorso-lateral band, and numerous longitudinal series of brown spots on the back..... **WEINLANDII** Cope.
- Keels 25, none larger; head flat, acute, muzzle longer than interorbital width; many close, short bay stripes; loreal higher than long..... **RADIUS** Cope.
- Keels 25 to 35, one median much stronger; head shorter, obtuse, muzzle equal width between eyes; unicolor, with vertical lateral bars; two loreals, longer than high..... **STENURUS** Cope.

III. Scales in 49—51 rows.

- Keels 34—8, the median stronger on dorsal region; form stout, fore-limb one-third longer than head; tail much compressed; yellow or light brown, with about fifteen brown cross-bands..... **OCCIDUUS** Shaw.
- Keels 17, scales with a cross elevation and marginal depression, making rows of pits; head wide, muzzle short, equal interocular width; tail cylindric; brown, with 18 cross-bars on dorsal region..... **IMPRESSUS** Cope.
- Keels 19, equal, scales plane; head elongate, narrow, muzzle longer than interocular width; brown, with 14 cross-bars on back..... **?STRIATUS** Gray.

AA. Internasal plates separate, small.

Scales in twelve longitudinal series on the dorsal region, with fifteen striae and a weak median keel; body anguiform, anterior limb long as head. Pale, with numerous short longitudinal reddish bands. Otherwise as *C. occiduus*." Dum. Bibr..... **OWENII** D. B.

Species unknown to the writer: *C. hewardii* Gray, Catal. l. c., from Jamaica, and *C. macrolepis* Gray, l. c., West Indies.

Synopsis of Species.

- C. STEINDACHNERI** Cope. *Diploglossus* Cope, Proc. Ac. N. Sci. Phila. 1864. Vera Cruz, Mexico. Mus. Smithsonian.
- C. CHALYBEUS** Cope. *Diploglossus* Cope, l. c. 1866. Vera Cruz, Mexico. Mus. A. N. S.; Smithsonian.
- C. FLEH** m. *Diploglossus* Dum. Bibr., v, 605. *Do. (oneyda)* Gray, Catal. Hab.—Martinique (Mus. Paris).

CHELESTUS DEGENER Cope, sp. nov.

This is the most *Seps*-like of the genus, having shorter and weaker limbs than the *C. sagræ*, and a shorter and broader head. The toes are very short, though of the normal number; it perhaps will approach the genus *Sauresta* Gray.

Width between fronts of orbits 1.5 times in length of muzzle anterior to same. Length of head to middle postparietal plate equal width of same at ear openings. Width of frontal plate behind greater than length of the same. Supraorbitals five, separated by two scales from parietal. One preocular; two loreals, both higher than long; an elongate oblique postnasal in contact with anterior supranasal. Nasal meeting rostral by a suture. Eight upper labials, fifth and sixth supporting a long suborbital, which is convex below. Two rows of infralabials, the upper of longer, lower of wider scales. Toes short; behind, fourth much shorter than first. Whitish below; chin reticulated with

[March,

brown. Sides with longitudinal brown lines, the upper confluent, much darker, and with a zig-zag upper margin. Above, fawn brown, with seventeen cross lines to middle of back, and small brown spots in quincunx behind them. Tail with a deep brown band on each side.

| | In. | Lin. | | In. | Lin. |
|---------------------|-------|------|-----------------------|-----|------|
| Length to vent..... | 3 | 2.25 | Length fore limb..... | 4 | 6 |
| “ to axilla..... | 11.75 | | “ hind limb..... | 7 | |
| “ to ear..... | 5 | 8 | | | |

A single specimen of this interesting species is contained in a collection from Porto Rico, West Indies, sent to the Smithsonian Institution by George Latimer, correspondent at that island.

C. SAGRE. *Diploglossus* Cocteau, Hist. Isle Cuba, Dum. Bibr. v, 602.

Hab.—The whole of Cuba. Mus. A. N. Sci.; Smithsonian.

CELESTUS PHOXINUS Cope, sp. nov.

A fusiform species, the body rather stout and flattened, the outlines tapering gradually to end of muzzle and tail. Head flattened, with strong canthus rostralis, and concave loreal region. Postnasal and postloreal longer than high: preloreal higher than long. Five supraorbitals; scales behind postparietals not larger than those of the nape. Dorsolateral angle strong on scapular region. The eighth upper labial is the first one angulated above; rostral plate broad and low. The limbs, when pressed to the sides, fail to meet by the length of the hand. Keels of the scales strong. Tail slightly compressed.

Above light gray; sides from orbit to groin dark brown, with regular vertical brown bars, which are margined behind by a close series of light spots. Two series of small brown spots on each side the dorsal region, the median stronger on the nape, all vanishing behind. Below immaculate; limbs with brown light-edged cross-bars.

| | In. | Lin. | | In. | Lin. |
|---------------------|-----|------|--------------------------|-----|------|
| Length to vent..... | 3 | 3 | Length to orbit..... | 3 | |
| “ to axilla..... | 1 | 2.8 | Greatest width head..... | 4 | 8 |
| “ forelimb..... | 8 | 6 | Length hind limb..... | 1 | 0.1 |

This elegant species was found by Dr. D. F. Weinland, near Jeremie, Hayti, and was placed by him in the Museum Comparative Zoology, Cambridge, Mass., in care of Prof. Agassiz.

CELESTUS WEINLANDII Cope, sp. nov.

This species is near the last, but is less regularly fusiform; the body, and especially the head, are less depressed; the canthus rostralis is depressed and the loreal region plane. Both loreals higher than long, and the seventh upper labial is the first angulated above. Rostral deeper, rounded above. Five supraorbitals, separated from parietals by but one plate besides frontoparietals. Auricular opening small. Limbs when pressed to sides meet. Larger median carina of scales wanting on those of anterior nape and tail. Vent with three cross rows, rather larger scales in front.

Below the dorsolateral brown band is another formed of spots in line; they continue with a vertical series of brown spots on the sides. Ground above dark brown; sides of neck and gular region brown-lined. Limbs with brown reticulations.

| | In. | Lin. | | In. | Lin. |
|---------------------|-----|------|-----------------------|-----|------|
| Length to vent..... | 3 | 6.8 | Length fore limb..... | 9 | 7 |
| “ to axilla..... | 1 | 4 | “ hind limb..... | 1 | 2.4 |
| “ to orbit..... | 3 | | Width head..... | 5 | 9 |

This species is found on Gonave Island, on the western side of Hayti. Mus. Smithsonian. From T. Younglove. Named in honor of Dr. F. Weinland, M D., of Frankfurt o. M., who has contributed much to the history of the Reptilia of Hayti.

1868.]

CELESTUS BADIUS Cope, sp. nov.

This species, though larger than either of the preceding, possesses a more acute muzzle; the front is plane as in *D. phoxinus*, but the snout lightly convex, though less so than in *D. weinlandii* and with obtuse canthus rostralis and plane loreal region.

The (sixth or) seventh upper labial is the first angulated above, while the suborbital and lower postorbital plates are shorter and deeper than in the preceding species; both loreals higher than long. There are two plates besides the fronto-parietal between parietal and the posterior of the five supraorbitals.

The limbs are short, and when pressed to the side fail to meet by the length of the hind foot. The digits of the fore foot are relatively shorter and weaker than in the two species preceding.

The eye fissure is small, measuring 2.5 times from its hinder margin to the ear; but twice in the *D. weinlandii*; it is less than double the diameter of the meatus. Transverse series of scales, from groin to above middle of meatus, ninety-four; those of the tail keeled like the rest. Three rows larger preanal scales.

| | In. | Lin. | | In. | Lin. |
|----------------------------------|-----|------|-----------------------|------|------|
| Total length (?tail reproduced.) | 8 | | Length fore limb..... | 9- | |
| Length to vent..... | 4 | 1- | " hind limb | 13.5 | |
| " to orbit | | 4.5 | " hind foot..... | 6.3 | |
| Greatest width head. | | 7.5 | | | |

Ground color cream, almost obscured above by many longitudinal bands and lines of bright bay; these are more or less broken up, of irregular width, and often confluent. Top of the head and sides closely spotted with bay, on the latter region in a longitudinal direction or in lines directed obliquely downwards and forwards. A dorsolateral band of ground color extends from superciliary region, more or less completely to the iliac, and is bay margined below and sometimes above. Throat and belly uniform yellow. Limbs bay red with white spots.

From Island of Navassa, W. I. From W. J. Rasin.

The collection sent to the Smithsonian Institution from this small Island consists of the following species:

| | |
|-----------------------------|-----------------------------|
| Typhlops sulcatus Cope, | Metopocerus cornutus Wagl., |
| Ungalia pardalis Gosse, | Celestus badius Cope, |
| Lioccephalus eremitus Cope. | |

CELESTUS STENURUS Cope. *Diploglossus* Cope, Proc. A. N. Sci. Phil. 1862.

From near Jeremie, St. Domingo. Mus. Compar. Zoology, Cambridge.

I append a description of another specimen, referred to this species with doubt.

This is a large species with broad head, and short muzzle, the latter being shorter than the width between anterior margins of eye fissures. First upper labial angulated above the seventh; suborbital and lower postorbital elongate, narrowed. Nasal very small; preloreal higher than long, loreal nearly square. Front convex, canthus obtuse. Eye fissure one-half distance to meatus of ear.

Eighty transverse rows scales from above meatus to groin. Supranasal plates small, narrow, the posterior nearly divided by the anterior (right) angle of the elongate internasal. Scales with from 26 to 35 keels, a median one rather stronger on some. Two scales bound the parietals in front besides the fronto-parietals. Four rows large scales in front of vent. The limbs pressed to the sides nearly meet.

Light-brown, with three rows of small subquadrate dark-brown spots on the median dorsal region. Limbs brown with light spots arranged in indistinct cross-bars. Head above light-brown with darker shades; labial plates above and below broadly brown margined. Below immaculate.

Length to vent 5 in. 9.7 lin. To orbit 5.1 lin. Width head behind 9.6 lin.

A number of digits in this single specimen exhibit a loss of the claws, others

[March,

have lost one, two or three phalanges. This may have a natural cause, since the allied genus *Panolopus* is deprived of these members entirely, though with well developed limbs.

From Gonave Island, near Hayti. From Thos. Younglove. The reptiles found by this correspondent in this island are :

| | |
|---|---|
| <i>Homalochilus fasciatus</i> Fisch., | <i>Diploglossus weinlandii</i> Cope, |
| <i>Dromicus parvifrons</i> Cope. (<i>D. protenus</i> Jan), | <i>Diploglossus ? stenurus</i> Cope, |
| <i>Uromacer catesbyi</i> D. B., | <i>Ameiva chrysolæma</i> Cope, |
| <i>Uromacer oxyrhynchus</i> D. B., | <i>Trachycephalus marmoratus</i> D. B., |
| <i>Liocephalus</i> . | <i>Lithodytes lineatus</i> Grav., |

CELESTUS OCCIDUUS Gray, Catal. *Lacerta occiduus* Shaw. *Diploglossus Shawii* Dum. Bibr., Erp. Gen. v, 590. Jamaica. Mus. Smithsonian.

CELESTUS IMPRESSUS Cope, spec. nov.

This is an elongate species with a tail cylindric for its proximal half, a little depressed at base; the body is quite cylindric and the limbs short. The ear is large and the head abruptly widened at the temples. The muzzle is short and flat, and the superciliary regions are slightly elevated above the frontal plane. Loreal region grooved. Ten upper labials, of which the eighth rises between suboculars. Postnasal distinct, prefrenal much higher than long, frenal square, two preoculars. Scales with equal keels, their hinder halves depressed.

The limbs appressed to the sides fail to meet by the length of the anterior without the hand.

| | In. | Lin. | | In. | Lin. |
|---------------------------------|-------|------|--------------------------|-------|------|
| Length to posterior edge ear... | 10.2 | | Length fore limb..... | 11.66 | |
| " to axilla..... | 19.75 | | " hind limb..... | 15.3 | |
| " to vent..... | 3 | 8.75 | " tail (reproduced)..... | 5 | 9. |

Color above olivaceous, below yellowish. Back and sides crossed by about 18 narrow brown bars, which are three times broken and alternating on each side the middle line. Tail cross-lined, throat and breast cross-banded less distinctly. Lateral plates, a short band behind orbit, and four quadrate spots above throat and axilla, deep brown.

Two specimens in Mus. Academy from Jamaica, collected by Charles B. Adams.

CELESTUS STRIATUS Gray, Ann. Nat. Hist. ii, 288. Catal. Brit. Mus. *Diploglossus cliftii* Dum., Bibr. v, 596.

Jamaica. Mus. Academy, Phila.

CELESTUS OWENII m. *Diploglossus* Dum., Bibr., do. (*Oneyda*) Gray, Catal. B. M. *Habitat*.—Unknown. (Mus. College Surgeons, London.)

AMEIVA Cuvier.

AMEIVA CHRYSOLÆMA Cope, sp. nov.

Char.—Twelve series abdominal plates; no horny tubercles on the heel; median and lateral gular scales equal. Frontal undivided, supraorbitals four. Teeth mostly bicuspid. Olive with numerous series of white spots, sometimes indistinct on dorsal region. Gular fold black, throat yellow; belly green and yellow.

Description.—One of the larger species. Four parietals and one interparietal, subequal. Two posterior supraorbitals bounded by granules within; frontal in front nearly broad as long; prefrontals longer than broad. Nostril in nasal plate near suture. A postnasal, one very large frenal, two preoculars and two suboculars. Labials 6—7, the anterior in both series very narrow. Infralabials eight in lower series, three in upper behind, all separated from labials by 1868.]

granules. Gular fold margined broadly with granules, with three larger series of hexagonal scales.

Brachials rather small, in seven rows above, and two below, not separated from antebrachials by granules, but joining an area of small scales in seven rows above, and ending in one row of broad and one of narrow antebrachials below. Postbrachials small, three rows larger. Tibial plates in four rows, two on under face, the outer of seven plates, of which the third and fourth are very large. Outer toes just exceeding inner. Femoral pores twenty.

| | In. | Lin. | | In. | Lin. |
|-------------------------|-----|------|----------------------|-----|------|
| Total length..... | 16 | 9. | Length to orbit..... | 8 | |
| Length to vent..... | 5 | 5. | " of fore limb..... | 2 | 1. |
| " to edge collar..... | 1 | 10.5 | " of hind limb..... | 3 | 9. |
| " of anterior claw..... | | 3. | " of hind foot..... | 1 | 10.5 |

Olive-green with five series of small white spots on each side, and seven on the dorsal region. The latter tend in a smaller specimen to form two pairs of incomplete dorsal stripes. Upper arm and hind leg with small white spots. One or two series white spots on the lateral abdominal scales. Latter blackish olive-yellow margined.

The anterior claws of this species are particularly large, and slightly curved. There are twenty teeth on each maxillary bone, which are nearly all bicuspid, the longest cusp posterior. In one individual there are mingled with these, posteriorly, three tricuspid.

Two specimens sent to Mus. Smithsonian from Gonave Island, on the western side of the Island of Hayti, by Thos. Younglove.

OPHIDIA.

TYPHLOPS Schn.

TYPHLOPS SULCATUS Cope.

This species exhibits most of the characters of the *T. lumbricalis*. These are, the presence of a preocular plate, the obtuseness of the muzzle plates, four upper labials, a nasal entirely divided by the suture through the nostril, and twenty longitudinal rows of scales.

It differs in the much greater prolongation and depression of the muzzle, and hence more slender form of the rostral and nasal, and greater prolongation backwards of the upper part of the preocular. In the existence of a strong groove along the sutures of these plates, giving the muzzle a trilobate outline from above. In similar deep grooves along the upper sutures of the labials and around the small frontal superciliary and interparietal scales. These scales are not larger than those of the body; a pair in place of the parietals are larger. The body is more slender than in *T. lumbricalis*, the length of the tail entering it 44.1 times. Tail short, acuminate conic. The length of the muzzle beyond the mouth equals from the nostrils to the opposite side of the rostral plate, or one-half the tail's length.

Color pale yellowish-brown; a darker brown line in the middle of each row of scales, on the anterior third of the length.

Total length 6 in. 5.2 l.; of tail 1.75 l.; greatest diameter 2 lines.

One specimen in Mus. Smithsonian from Navassa Island, southwest from St. Domingo.

UNGALIA* Gray.

Tropidophis Bibr. *Notophis* Hallowell.

Thirty-five individuals, representatives of this genus before me, indicate a greater number of species than are at present recognized by naturalists. Some of the additional ones have been already named and imperfectly described.

All that are known are from the Bahamas, Cuba, Navassa and Jamaica, a remarkably local distribution. They are distinguished as follows:

* The correct spelling of this name is probably Ungualia.

[March,

I. Scales in twenty-seven rows, keeled.

- Gastrosteges from 200 to 209; five or six lateral rows smooth; yellow with black end of tail..... *MELANURA*.
 Gastrosteges 169—189, nine or more lateral rows smooth; brown with rows of brown spots; tail not black.... *PARDALIS*.

II. Scales in twenty-one—five rows.

- a. Scales keeled, a larger dorsal row;
 Gastrosteges 168; scales in twenty three rows; gray with small dorsal spots..... *CANA*.
 aa. Scales smooth, dorsal rows equal.
 Short, stout, gastrosteges 142—150; head lanceolate; scales in 23—25 rows; brown or gray with usually dorsal and lateral spots..... *MACULATA*.
 Long slender, head small lanceolate; gastrosteges 202—5; scales 21—3 rows; yellow with nearly complete broad brown rings or half rings..... *SEMICNOTA*.
 Long slender, head broad short; gastrosteges 211, scales 25 rows; brown with six rows of black spots..... *DIPSADINA*.

The normal number of postoculars in this genus is three, but variations are not unrequent. Thus a specimen of *U. maculata* has but two postoculars on each side, another has two on one side only. Another has a complete circle of five scales round the eye on one side, and three postoculars on the other. I have seen no specimen with two preoculars as in the specimen figured by Jan as *T. distinctus*, but as the species does not appear otherwise different from *U. maculata*, I suspect that this character also falls within the range of the variations of the latter.

UNGALIA MELANURA Gray, *Boa*, Schlegel.

There are two varieties of this species.

a. A narrow brown vertebral line; crown not spotted; (*Notophis bicarinatus* Hallow.), three specimens from Cuba, two of them from the east; one with two keels on the vertebral row, the others with one.

β. (*Boa melanura* Schleg.) Two dorsal series of brown and gray spots, top of head much spotted. Five sp. from Cuba.

UNGALIA PARDALIS, *Boa Pardalis* Gosse, *Ungalia maculata* Gosse.

Var. a. Shorter, gastrosteges 169; eight rows of spots, belly blotched. One sp. from Jamaica (Adams coll.) Smithsonian, 5763.

β. *U. bucculenta* Cope. Larger, gastrosteges 186—9; four rows of spots, dorsal pairs much confluent, belly specked; head swollen behind. Four specimens from Navassa Id. Mus. Smithsonian. The largest of these measures 25 inches in length.

UNGALIA CANA Cope, sp. nov.

This species is intermediate between the *U. pardalis* and *U. maculata* in many respects. Superior labials ten, all higher than long; orbitals 1—3. Internasals longer than broad; prefrontals broader than long; postfrontals pentagonal, nearly equal sided. Temporals 3—3—4. Scales, except six external rows, weakly carinate. Muzzle narrow, acuminate, head rather wide behind; diameter of eye a little over twice in length muzzle. Total length 13 in. 9 lin.; tail 16.5 lines. General form neither very stout nor slender.

Color gray brown above, below yellowish gray, densely punctulated at middle of gastrosteges. A series of tolerably approximated transverso-dorsal spots, which are short, and little distinct, in some specimens almost wanting. On each side on the third row of scales is a series of black dots two or three scales apart. A brown band from eye to side of neck, the labials below it yellowish; mental region yellowish.

Several specimens from the Bahama Island of Inagua sent to the Smithsonian.

1868.]

UNGALIA MACULATA Gray. *Tropidophis* Bibron. *Tropidophis distinctus* Jan. Elenco et Iconographie.

α. Two rows large spots on each side, the upper series usually confluent; a large series each side the vent extending half across it; eight specimens from Cuba.

β. Two rows small spots on each side, those of the dorsal rows separate; no large blotches on the belly. Three sp. from New Providence; Bahamas.

γ. Gray without spots or with traces only. Three sp. from New Providence.

In this species two or three labials may enter the orbit irrespective of the number of postoculars.

UNGALIA SEMICINCTA. *Ung. maculata*, var. *semicincta* Gundlach and Peters, Monatsberichte Preuss. Acad. 1864, 388.

This is a handsome and distinct species, described as a variety as above, most probably, though the authors have not noted its essential peculiarities of proportions of body and the number of scuta.

Three specimens (2 Smithsonian, 5746) from Eastern Cuba. Chas. Wright.

UNGALIA DIPSAIDINA Cope, sp. nov.

This is a long slender species, much compressed, with slender neck, and small flat and broad head; its form is thus more like that of *Dipsas* than any other of the genus. The anterior upper labials are larger than in the other species, the second reaching to the preocular on one side, and within a hair's breadth on the other. Ten labials on one side, nine on the other, two only in orbit. Oculars 1-3; temporals 3-3-4; internasals and prefrontals of equal length; occipitals short, separated by two scales. Eight dorsals, and the basal series of scales larger than the lateral scales, some of the latter slightly roof-shaped. Two pairs of longer genials. The eye is larger than in the other species, its diameter entering the length of the muzzle 1.5 times. The width of the head behind nearly equal its length from the end of the muzzle to near the end of the occipitals. The diameter of the body an inch behind the head, one half that of the thickest part of the body. Urostege 42.

Color above a deep reddish brown, with a row of black spots on each side the median line about two scales wide, and always distinct, and two alternating rows of smaller black spots on each side. A series of blackish cross-bars on the belly, two and three scuta apart, sometimes divided and alternating, invade the first row of scales; no spots for two inches behind the chin. Head dark above, with a darker spot on the occipital region. Ground color below, yellowish brown.

Total length 15.5 in.; of tail 2 in.; of gape 6 lin.

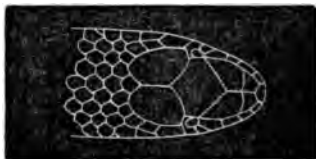
Habitat.—Cuba, section unknown. Discovered by my friend Prof. Poey, of Havana, who sent a specimen to the Museum of the Academy of Natural Sciences.

COLOPHRYS Cope, gen. nov.

Teeth equal. Anal shield simple, subcaudals divided. Two pair genials and frontals; no preocular or superciliary, the vertical forming the eyebrow; two nasals. Scales smooth.

COLOPHRYS RHODOGASTER Cope, sp. nov.

Scales broad, in seventeen longitudinal series. Head slightly contracted, obtuse, depressed. Rostral shield visible from above; prefrontals moderate, their common suture little less than that of postfrontals; nasals large, as long as loreal,



[March,



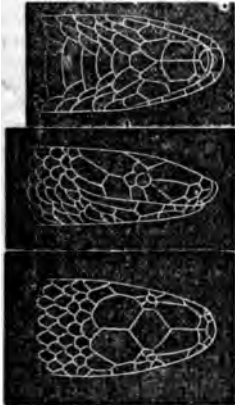
postnasal longer. Vertical (frontal) angulated in front, more acutely behind, where it has two sutures on each side, owing to its confluence with the superciliaries—the exterior being the posterior sutures of the latter. Parietals much longer than wide, only margining anteriorly the whole of the narrow single postorbital. Labials six, all higher than long except the sixth, which only is separated from the parietals by a single temporal. Second superior labial in contact with postnasal and more with boreal; third and fourth with orbit and postocular. Inferior labials seven, five in contact with genials. Scales in contact with parietal, 1 temporal, $4\frac{1}{2}$ squamæ. Gastrosteges 144, urosteges 30; in a second specimen 140—41. Length of largest specimen 12 inches; tail 2 in. 1.5 lines.

Color of upper surfaces a rich slate brown, very iridescent; lower surfaces, including first series of scales with labial and rostral shield, red orange.

Three specimens of this species were brought by Dr. Van Patten from the elevated country in the neighborhood of the city of Guatemala. It bears considerable resemblance to the *Catostoma chalybaeum* Wagler, but besides the lack of superciliary shields, its eye is smaller and the head more compressed. In the *C. chalybaeum* there are but six inferior labials, of which four margin the genials; it has also shorter nasals, and a vertical more truncate anteriorly.

CATOSTOMA Wagler.

CATOSTOMA NASALE Cope, sp. nov.



This species has, like that preceding and that following, seventeen rows of scales, of which those on the posterior part of the body and tail are weakly keeled, thus differing from the *C. chalybaeum* where they are smooth. It also differs much from the same in the elongated form of the head and the great disparity in size between the pre- and postfrontal shields. In this species the former are less than one-fourth the latter in longitudinal extent, and about half in the transverse. The supraorbitals are very small and subtriangular, the vertical broader than long, and what is unusual, as much angulated anteriorly as posteriorly. Parietals longer than broad, the anterior margin touching the postocular and superciliary. Superior labials eight, the last only separated from parietals by a temporal, which is large in two, small in one specimen. First labial very small, third longer than high. Inferior labials seven, four in contact with genials. Seventeen rows of scales,

which are small and more crowded above the vent than in any other species. Gastrosteges in three specimens 131—3—4; urosteges in the same 25, 30.

Color above, including labial region and chin, iridescent slate brown; belly and gular region pale yellow. Length of largest specimen 11 in. 1.5 lines; tail 2 in.

This species is probably nearly allied to the *C. sieboldii* of Jan, of which but few peculiarities are described. Jan's account of the scutellation indicates a more elongate species no doubt distinct; the scuta vary from g. 146—154, u. 34—8.

Several specimens from near the city of Guatemala, presented to the Smithsonian Institution by Dr. Van Patten. Mus. Ac. Nat. Sci. Phila.

1868.]

RHADINÆA Cope.

The genus *Rhadinæa* is nearly coextensive with *Henicognathus* Jan, and *Ablabes* Günther. *Ablabes* of Dum. Bibr. was, however, established on the *Coronella rufula* of Schlegel, which has the prolonged series of gastric hypapophyses, and is therefore quite different, while *Henicognathus* is characterized by a peculiar structure of the mandible, which so far as I am aware occurs in only one American species, the *H. annulatus* D. B. Consequently the majority of species attached to this genus belong to *Rhadinæa*, as the *E. melanocephala* D. B. etc. In the description of this last species, three are mingled, as I have ascertained both from a reading of the same, and from an examination of the originals in Mus. Paris. One of these is our *R. obtusa*, the other is the true *R. melanocephala*, which should be described as follows, and the third is a species as yet undescribed, which I call *Lygophis nicaeus* Cope. Duméril and Bibron give both the Island of Guadeloupe and Brazil as habitats of their species. I suspect, however, that the specimen of *R. obtusa* was accidentally introduced into the jar containing the other two, and that it is confined to South America, where it is not uncommon. It is figured by Jan in his *Iconographie*, as the second specimen of *R. melanocephala*. His first specimen of the same as figured, is our *Lygophis nicaeus*, a serpent with a diacranterian dentition.

The true *R. melanocephala* is probably confined to Guadeloupe and the neighboring islands. Its description has been so mingled with those of the two other species as to require a redescription. It is to be regretted that this, the type of the species, should not have been figured in the beautiful work of Jan and Sordelli.

RHADINÆA MELANOCEPHALA. *Henicognathus melanocephalus* D. and B., part.

Head broader and shorter. Common pre- and postfrontal suture $2\frac{1}{2}$ times in length, from vertical ant. sut. to end occip. suture, and equal diam. eye. Vertical a little longer than occip. Common sut. occip. = anterior sut. occip. Postfront. descending low on (sides of) loreal seg. Loreal longer than high, 8 and 9 sup. lab., 4 and 5 or 4? 5 and 6 in orbit; of the 3 behind the 5th or 6th—1st is higher than long, 2d longer than high, 3d and last of all twice as high as long. Temporals 2 | 2 | 2 | the infer. of 1st row between penult. and antepenult. labials. Yellow band round canthus rostralis and upper part of rostr. plate edge of supcil. and across post. part of supcil. and vert.; brown area enclosed. Occips. brown, connected by long. line with broad brown collar yellow edged, which is 6 scales long. Yellow vertebr. band on median row sc. with occasional round brown spot on a single scale, small round spot on end gastrosteges. Labials yellow, edged above with brown. Tail 10". Total 32" 5'''.

From Guadeloupe. Mus. Paris.

LYGOPHIS (Fitz.) Cope.

LYGOPHIS NICAEUS Cope. *Henicognathus melanocephalus* Jan, *Iconographie* Livr. xvi. Tab. 1, fig. 4, (not of Dum. Bibr.)

Length of comm. suture of pre- and postfront. one-third dist. from anter. suture vertic. to end of comm. sut. of occipitals. Vert. long, sides straight, converg., as long as comm. sut. occip. Occip. long, a little divaricate at tips. Diam. eye = comm. suture pre- and postfronts.; 7 sup. lab.; 3, 4, 5 in orbit; 7th largest, higher than long, 8th longer than high. Loreal higher than long. Temp. 1 | 2, 17 r. sc. Below yellow, immaculate, near end of gastrost. a longit. spot, forming together longitud. line. Above this line brown, darker to 4th row of sc., forming band with numerous light points mixed; and on 8, 9, 10 rows where a median longitud. band is formed with undulatory edges and varied with whitish points. On anter. part body the intermediate

[March,

pale lateral band crossed by vertical brown bars. Dark spot on nape and middle of occip., which are bordered all round with pale and have a pair pale spots in middle (*Tropidonotus* style.) Superciliar. with a posterior border. Tail 7'' 7'''. Total 36'' 3'''.

XENODON Boie.

A review of the species of this genus is given by Günther in *Ann. Mag. N. History*, 1863, 353, in which he enumerates six species. He omits the East Indian species, and places them in *Tropidonotus* in his volume on the Reptiles of British India,—an arrangement which I had long thought necessary, on account of the hypapophyses of the posterior vertebrae of the latter (vide *Proc. Acad.* 1864). Jan places *Liophis bicinctus* of Dum. Bibr. with *Xenodon gigas* D. B., a closer approximation to nature than any other arrangement. He, however, regards them as a genus distinct from *Xenodon*, the truth of which position I doubt, and refer them both to *Xenodon*. The species of the latter genus will then be as follows, two not previously known being added:

- I. An orbital ring of scales.
X. bicinctus. *X. gigas* Dum. Bibr.
- II. One labial entering the orbit.
X. irregularis Gthr.
- III. Two labials entering orbit.
 - a. Eight superior labials.
 - β. Anal bifid.*X. severus* L. *X. neovidii* Gthr.
- ββ. Anal entire.
X. colubrinus Gthr. *X. suspectus* Cope, sp. nov. *X. angustirostris** Peters.
- αα. Seven superior labials.
X. rhadocephalus Boie.

I have before me, of *X. gigas* two sp., *X. severus* five sp., *X. neovidii* one sp., *X. colubrinus* three sp., *X. suspectus* one sp., *X. angustirostris* four sp.

XENODON SUSPECTUS Cope.

Scales in nineteen longitudinal rows, in transverse series and very imbricate. Body rather slender, compressed, head distinct ovate, plane in profile, the muzzle not depressed or arched. End of muzzle not projecting; eye large, contained $1\frac{1}{2}$ times in length muzzle, and $1\frac{1}{2}$ in interorbital width.

Prenasal more elevated than postnasal; loreal large, higher than long. Two postoculars, the superior considerably more elevated, in contact with one temporal, which is higher than long; sixth and seventh labials higher than long, the seventh not reaching postoculars, separated from occipital by two temporals. Last labial a little longer than high. Supraorbitals each a triangle truncate anteriorly. Frontal nearly long as broad, subtriangular, the occipital sutures being very short. Occipitals very short, subtriangular, sides concave, width equal common suture. Inferior labials 9 (one less than other species); genials, the pairs short, equal. Gastrosteges 134, urosteges 35.

Color: above a bright dark olive, with fourteen blackish cross-bars contracted in the middle, as wide as their interspaces; the ground color appears in the middles of these bars, reducing them to skeletons. Sides of belly black, with irregular bright yellow spots, most distinct on the end of every other scutum. Top of head with ground like the back, and, like it, thickly covered with black specks. Sides of head and of muzzle black, speckled

* Two specimens of this species are in the museum of the Academy, presented by Drs. Gallar and Le Conte. Two other specimens, of unknown locality, are to be referred to the same.

with yellow, on the temple abruptly bounded above by the olive in a line to rictus. Labial plates with a yellow blotch in the middle. An indistinct brown band on each side the head from the occipitals backwards. Throat bright yellow, with black blotches behind, which continues on the anterior fourth the length. Belly brown, clouded yellow laterally, becoming blacker behind; tail yellow below.

Total length 22 in. 4 l.; of tail 3 in.; of gape 11 l.

This, the brightest species of the genus, was brought from Lake Jose Assu by the Thayer Expedition to Brazil, under direction of Professor Agassiz. M. C. Z. 362.

EUTÆNIA Bd. Gird.

EUTÆNIA PHENAX Cope, sp. nov.

This is a handsome and peculiar species, being the only one of the genus which is cross-banded.

Scales in nineteen rows. All keeled except the first. General form much as in *E. sirtalis*. Head rather short, muzzle obtuse, eye large, superciliary plates arched. Diameter of eye equal from same to rostral plate along the labials. Frontal shortened behind, with straight sides, .75 of parietal common suture. Parietals truncate behind. Upper labials eight, fourth and fifth in orbit. Loreal longer than high, one preocular, temporals 1—2. Inferior labials nine, sixth largest; genials equal. Urosteges 63; anal 1; gastrosteges 161.

Total length 23 in. 5 l.; of tail 5 in.; to rictus oris 9 lin.

Coloration. Above reddish-olive, crossed by thirty-six transverse spots, which are of a bright brownish-red, with a narrow black margin. They are separated by transverse intervals of only a scale in width, hence the black margins appear as paired cross-bars. These cross-bars extend to the first row of scales, and are as often continuous on the side as not. There is no lateral stripe, but there are black spots on the corner of the end of the gastrosteges. The margin of the first brown spot is in form of two black lines, diverging from the parietal plates backwards. There is a brown bar in front of frontal, one on the frontal and superciliaries behind (imperfect), and a longitudinal on each parietal. No pair of light parietal spots. Labials below eye with the last black-margined, otherwise light olive. Below, a strong green, unspotted.

This species is common near Cordova, Vera Cruz, whence Francis Sumichrast has sent specimens to the Smithsonian Inst. and Mus. A. N. S.

MASTICOPHIS Bd. Gird.

MASTICOPHIS MELANOLOMUS Cope, sp. nov.

A slender species, with one preopercular plate, and smooth scales in fifteen longitudinal series. Loreal an elongate parallelogram, not encroaching on the preocular. Postoculars two, the inferior very small. Superior labials nine, the fourth, fifth and sixth in orbit, seventh subtriangular, eighth and ninth longer than high. The last mentioned are separated from occipitals by two horizontal series of temporals, each of three plates, the anterior of the lower, and posterior of the upper, the longest, lower posterior widest. Occipitals broadly emarginate behind, their width in front equal the common suture and four-fifths frontal plate. Latter much narrowed; superciliaries broad, projecting. Internasals a little longer than broad, rostral just visible from above. Inferior labials ten, postgenials considerably longer than pregenials. A row of plates in an open chevron bounds the occipitals and temporals behind. Scales of body not narrowed; anal as in the genus, divided.

Gastrosteges 184; urosteges 128. Total length 44 in. 3 l.; of tail 14 in.; of rictus oris 1 in. 1 l.

Coloration grayish-olive, all the scales with a narrow black border, which become longitudinal lines on the posterior part of the length; one of these,

[March,

on the line of the second and third rows of scales, extends throughout the posterior five-sixths the length. A dark shade through eye. Middle half of gastrosteges yellow.

From Yucatan; A. Schott, of the Comision Cientifica.

I had enumerated this as the *M. bilineatus* of Schlegel (Pr. A. N. S. 1866, 127), but an examination of Jan's beautiful figure enables me to correct the error.

LEPTOGNATHUS Dum. Bibr.

Günther, Jan.

A review of the species of this interesting genus has been already given. I give here references to all the species, and descriptions of some new ones not contained in the Williams College collection.

LEPTOGNATHUS BUCEPHALA Cope, Shaw, see Catalogue.

LEPTOGNATHUS VARIEGATUS Dum. Bibron, Erpet. Gen. vii, p. 477. *Dipsadomorus* Jan.

From Surinam. No specimen of this species has fallen under my observation.

LEPTOGNATHUS CATESBYI Günther, Weigel. See Catalogue.

LEPTOGNATHUS PAVONINA Dum. Bibr. Schleg., Erpet. Gen. vii, 474. Guiana.

LEPTOGNATHUS ARTICULATA Cope, sp. nov. "*Dipsas brevis* Dum. Bibr.," Cope, Proc. A. N. Sci. Philada. 1860. Not of Dum. Bibr.

The most slender, compressed species of the genus. Muzzle very short; frontal plate hexagonal, sides converging, length equal width; occipitals broad and squarely truncate behind, not reached by the vertebral series of plates. Fourth and fifth superior labials entering orbit, sixth nearly excluded by the long lower postocular. Temporals two—three, with one inferior additional in contact with postocular. Sixth and seventh inferior labials connected by one transverse plate.

The brown annuli are wider anteriorly than posteriorly; the second covers $10\frac{1}{2}$ rows of scales, the seventeenth, just in front of the vent, $6\frac{1}{2}$. The yellow annuli are of nearly uniform width— $4\frac{1}{2}$ scales,—and without spots above or below. Top of head, sides, and upper labials in front of eye, all the lower labials, brown; rest of head with numerous short lines on the muzzle, yellow or white.

Gastrosteges 215; anal 1; urosteges 135. Total length 26.5 in.; of tail 8.75 in.; of gape 6 in.

From Veraguas, Costa Rica; sent to the Academy by R. W. Mitchell.

LEPTOGNATHUS MIKANI Günther, Schlegel. *Ankolodon mikani* Dum. Bibr. vii, 1165.

Eastern Brazil.

Body not elongate, but much compressed. Head less elevated, and with flatter muzzle than in the last.

Loreal square; frontal nearly equally hexagonal, with straight sides; occipitals elongate, rounded posteriorly. Third and fourth labials bounding orbits, the anterior little higher than long, posterior two much longer than high. Temporals $1\frac{1}{2}$, all longer than high, anterior in contact with both postoculars.

Dorsal cross-bands two scales wide, four scales apart, with zig-zag outlines from never crossing a scale. Posteriorly their extremities are broken off into a lateral series of spots. Belly with a series of elongate blotches on each side, which alternate with the lateral spots; dusted with brown medially. Top of head dark brown, with five darker light-edged spots; one on the junction of prefrontals with frontal, on one outer posterior angle of latter, and one on each occipital plate. Labial plates all reddish-brown margined.

1868.]

Gastrosteges 165; anal 1; urosteges 74. Total length 16 in.; of tail 3-75 in.; of gape 5 l.

From Bahia, Brazil. Spec. in Mus. Academy, presented by E. D. Cope.

LEPTOGNATHUS VAGA Jan., *Elenco Systematico* (nondescripta).

This species has not been described, so far as the writer is aware, but it can be assigned to its place in consequence of an examination of the original specimen, which was permitted the writer through the attention of Prof. Jan.

It belongs to group II, and has but two postocular plates; of its preoculars nothing can be said. Superior labials eight. There are four pairs of genials. General form less compressed than the types, with rather short body and tail. Above wood-brown, with indistinct cross series of spots. Below yellowish, tessellated with brown. Size not large for the genus.

This species is said to have been brought from Hong Kong, but this is altogether improbable; it is probably South American.

Another species, *L. incertus*, from Surinam, is named but not described by Jan, and is therefore likely to remain *incertus*.

LEPTOGNATHUS BREVIS Dum. Bibr., vii, 476.

This species is not described in sufficient detail to allow me to refer it to its place in this genus. It appears, however, to be different from any species here enumerated, though it has the coloration of several Mexican species.

Mexico, Dum. Bibron.

LEPTOGNATHUS ORNAS Cope. See preceding Catalogue.

LEPTOGNATHUS INÆQUIFASCIATA Cope. *Cochliophagus inæqui*. Dum. Bibr., vii.

From Brazil, with doubt. D. B.

LEPTOGNATHUS NEBULATA Günther, Linn. *Petalognathus* Dum. Bibr. *Celester variegatus* Hallowell, Pr. A. N. S. ii, 214. See Catalogue.

LEPTOGNATHUS ANTHRACOPS Cope, sp. nov.

A strongly marked species, having a general resemblance to the *L. sartorii*.

Muzzle short, narrowed, frontal plate longer than wide, with straight sides; occipitals not shortened, broadly rounded behind. Anterior three labials narrow and high, fourth and fifth only touching orbit. Sixth upper labial much higher than long; seventh much longer than high. Inferior postocular larger than superior. Temporals rather small, subequal, 1 | 2 | 3; loreal longer than high. Sixth inferior labial enlarged. Second pair genials longer than wide, third pair wider than long.

Yellow annuli, 9½ rows scales apart anteriorly, four rows distant posteriorly; yellow rings, wider behind. There are twenty-three on the body, twelve on the tail. They are often alternating on the belly, which is otherwise unspotted. No white markings on top of head.

Gastrosteges 177; anal 1; urosteges 76, some dozen or more at the tip of the tail undivided in the individual at hand.

Total length 19 in. 8 l.; of tail 5 in. 3 l.; of gape 4-75 l.

From Central America; one sp. in Mus. Academy from E. D. Cope, procured from the traveller and collector, Robert Bridges.

LEPTOGNATHUS BREVIFACIES Cope. *Tropidodipsas brevifacies* Cope, Proc. A. N. Sci. Philada. 1866.

From Yucatan.

LEPTOGNATHUS TURGIDA Cope, sp. nov. "*Cochliophagus inæquifasciatus* D. B.," Cope, Proc. A. N. Sci. Philada. 1862, 347; not of Dum. Bibr.

This species has the head very little distinct from the body when viewed from above, and the neck but little compressed. In profile the frontal region is seen to be concave, and the top of the muzzle swollen both longitudinally and transversely. The internasals are but little broader than long; the same

[March,

may be said of the large prefrontals. Frontal hexagonal, scarcely longer than broad, with strongly convergent sides. Occipitals narrowed, emarginate behind. Temporals 1 | 2 | 2, the anterior not large, in contact with both post-oculars and fifth and sixth upper labials. Seventh labial bounded by two. The five anterior labials are higher than long, the two others a little longer than high, third and fourth entering orbit. Loreal longer than high. Eight inferior labials, fifth with greater transverse than longitudinal diameter.

Gastrosteges 159; anal 1; urosteges 41.

Color above a rich yellow-brown, with a series of black spots on the dorsal region, which are longer anteriorly, but separated by nearly equal spaces of 1.5 to 2 scales; length of third spot 7.5, scales of tenth, three scales. Behind the third spot the lateral portions are separated and sometimes divided, and extend to the ends of the scuta. Below nearly unspotted, except on tail. Gular region also immaculate. Head above thickly dusted with brown, paler on nape and top of muzzle. A pair of deep brown, yellow-edged spots on each occipital plate, converging behind; labials brown-dusted.

This is one of the most handsomely colored of the species, and of aberrant form.

From the Northern part of the Paraguay river.

LEPTOGNATHUS FASCIATA Cope. *Tropidodipsas fasciata* Günther, Catal. Snakes Brit. Mus., 1858.

From Mexico.

LEPTOGNATHUS SARTORII Cope. *Tropidodipsas* do. Cope, Proc. Acad. Nat. Sci. 1863, 100.

Vera Cruz, Mexico.

BATRACHIA.

PROSTHERAPIS INGUINALIS Cope, genus et species novæ Colostethidarum.

Char. gener.—Xiphisternum membranous (difficult to discover), manubrium a bony style, with cartilage disc; metatarsus slightly webbed, dilatations strong, each with two dermal scales on the upper side, separated by a fissure; terminal phalanges small, T-shaped; tongue cylindric, free; no vomerine teeth; belly not areolate. Pupils longitudinal. Ethmoid well developed anteriorly, the prefrontals lateral, well separated.

This genus is interesting, as constituting the second of the little known family of the Colostethidae, which was established by the writer in 1867. Its general appearance is that of a Phyllobates, and it is related to Colostethus much as Limnocharis is to the first-named. The two leathery scales of the pallettes are peculiar, and resemble those of the under side in Phyllodactylus. The distal phalanges are short, and extend very little into the dilatation.

Char. specif.—Muzzle and canthus rostralis angulated, the former projecting, rounded, truncate from above; the loreal region nearly vertical. Nostril nearly terminal, eye large, its long diameter equal to near end of muzzle. Membrana tympani concealed. Skin everywhere smooth, a weak fold on the distal half the tarsus. Free portions of the metatarsi only webbed, all the toes with strong dermal margin; the fingers with a weaker one. Digital dilatations extended rather transversely; two metatarsal tubercles, both small, inner elongate. Inner nares almost lateral, ostia pharyngea small, half the size of the former.

Width head and jaws one-third length to end coccyx, and equal length head to opposite usual position of posterior margin tympanum. Heel to middle of orbit, wrist to beyond end muzzle.

| | Lin. |
|-----------------------------|------|
| Length head and body..... | 12.5 |
| “ fore limb..... | 8 |
| “ hind limb..... | 18.5 |
| “ foot without tarsus | 5.6 |

1868.]

Color dark brownish-leadен, below dirty white. The almost black of the sides bounded below by an irregular pale border, below which are some dark marblings. The same border extends, with an axillary interruption, to the orbit, and continues on the upper lip as a series of light dots. A light band commences at the groin above, and extends to opposite the sacrum, converting the dark color of the side into a half-band. Femur and tibia dark, marbled before and behind.

From the river Truando, New Grenada. Brought by the expedition under Lieut. Michler, by Arthur Schott. This species and the *Dendrobates tinctorius* Wagl. were accidentally omitted from the report of this expedition, published in Proc. Acad. 1862, 355.

BUFO ARGILLACEUS Cope, sp. nov.

Ridges of cranium superciliary and supratympanic; no parietal branch. Parotoids elongate trigonal, the long angle prolonged towards the sides. Two weak metatarsal tubercles. A tarsal dermal fold; toes little webbed. Muzzle elongate, not much depressed or projecting beyond labial border. No pre-orbital ridge; superciliaries nearly parallel. Skin rather finely rugose.

Males olive-grey; females with a pale vertebral line, and a series of brown spots on each side of it. Crown, lips, and below unspotted. Length of head and body 2 in. 9 l.

This species is to be compared with the *B. granulatus* of Spix, which it represents in another region. It differs in lacking the preorbital ridge, and having a longer muzzle.

Numerous specimens in Museum Smithsonian from Colima, Western Mexico, from U. S. Consul, John Xantus.

Second Supplement on some New Raniformia of the Old World.

TOMOPTERNA LABROSA Cope, sp. nov.

Head raniform, little elevated; end of muzzle recurved, loreal and suborbital regions concave, the edge of the maxillary region strongly projecting. From orbit to margin of jaw below it less than diameter of tympanum, two-thirds that of orbit. Tympanum elliptic, subvertical, about .66 long diameter eye fissure, latter .2 greater than from edge of same to external nostril, and 1.5 least interorbital width. Frontal and prefrontal regions slightly grooved medially. Vomerine teeth in two very short, nearly transverse, lines opposite the middle margin of the inner nares. Latter large, about equal to ostia pharyngea.

When the limbs are extended the carpus attains the end of the muzzle, and the heel the middle of the orbit. Tarsus equal third toe without last two phalanges. Cuneiform shovel small for the genus, equal inner toe less the last phalange. Webs large, measuring .66 the third and fifth toes. Thumb longer than second and fourth fingers. Skin of upper surfaces with numerous narrow irregular folds; eyelids slightly rugose behind. A strong fold above the tympanum decurved behind it.

| | In. | Lin. | | In. | Lin. |
|-------------------------------|-----|------|------------------------|-----|------|
| Total length head and body... | 2 | 4.5 | Length tarsus..... | 1 | 6. |
| " " hind limb..... | 3 | 4.5 | " " foot..... | 1 | |
| Length tibia..... | | .13 | Width head behind..... | 1 | |

Color above gray-olive, with paired blackish spots, on each side a light vertebral band. The anterior of these are a triangular blotch on top of muzzle and band across middle of each eyelid. Side of head blackish-gray with a pale gray band on end of muzzle, one from front of orbit to lip, and one below eye, longitudinally past lower edge tympanum bordered by blackish from orbit backwards. Femur with three, tibia with four, and outer edge foot with four blackish-gray cross-bars; femur pale-brown behind.

[March,

This species is more slender in form than the others of the genus, and exhibits a fuller palmation of the feet; it does not differ more from the species of *Hoplobatrachus* Pet. than the *Rana* do among themselves. One spec. (283) has the whole upper surface of the head, and a broad vertebral band yellow. Of the types are two specimens (No. 283) in Museum Comparative Zoology, Cambridge, all from Madagascar, presented to Prof. Agassiz by G. W. Goodhue.

TOMOPTERNA POROSA Cope, sp. nov.

Toes nearly completely webbed, 2·3 phalanges of the fourth toe free. Muzzle obtuse ovate from above, decurved in profile, as long as diameter of eye-slit. Top of front and muzzle plane, canthus distinct, contracted, obtuse loreal region with a longitudinal concavity. Tympanum round, nearly as large as eye, distinct. From orbit to maxillary border ·66 diameter tympanum; lip rather prominent below orbit. Vomerine teeth in two fasciculi opposite middle or hind margin of choanæ, nearer each other than margin. Choanæ smaller than the large ostia.

Fingers with very small web at base, thumb longer than second, equal fourth. Tarsus of extended limb beyond end muzzle; heel to front of orbit. Tarsus 2·3 times in longest toe. Cuneiform shovel 2·66 times in tarsus.

| | In. | Lin. | | In. | Lin. |
|----------------------------|-----|------|----------------------------|-----|------|
| Length head and body | 2 | 1·75 | Length head to tympanum | | |
| Hind limb | 3 | 3·75 | behind..... | | 8·25 |
| Tibia..... | | ·11 | Width head same point..... | | 9· |
| Hind foot..... | 1 | ·7 | | | |

A glandular dermal fold from above tympanum to above groin on each side; the greater part of the eyelid glandular and covered with pores. A glandular fold from angle mouth to behind above axilla. No tarsal folds.

Color above brown, with dark-gray shades; in one specimen an imperfect pale-gray vertebral line. Under surfaces white, sides coarsely and handsomely marbled with brown and white below and gray above. Head dark-brown, a pale line on the lip, a slight margin to lower lip. Femur brown with pale marblings.

This species is abundantly different from those hitherto known, and seems to indicate that the genus *Hoplobatrachus* Peters is less distinct from *Tomopterna* than hitherto supposed.

Three specimens (No. 305), Agassiz' Mus. Compar. Zoology, Cambridge, Mass. From Kanagawa, Japan. From Dr. Jas. T. Gulick.

HYLORANA LEPTOGLOSSA Cope, sp. nov.

This species is most nearly allied to the *H. temporalis* Günther of Ceylon. The points of difference are *italicised* in the following description:

Hind limbs as in *H. temporalis*, and the fourth toe is only ·33 longer than the third and fifth. Two well marked metatarsal tubercles. Vomerine teeth in two very short oblique rows commencing opposite the posterior margins of the choanæ and directed backwards; they are about as far from each other as from choanæ. *Tongue narrow, not filling rami of jaws.* Tympanum as large as eye; *latter contained 1·5 times in length of muzzle, extending beyond nostril.* A heavy glandular dorsolateral fold, *separated by a groove from another interrupted one below it.* A deep groove from axilla to near groin. *A short glandular fold from angle of mouth.* *Muzzle flattened acuminate at the end.* Heel of hind limb to front of orbit. Fourth toe more than half length head and body; *no dermal fold on upper edge of tarsus.*

Above olivaceous, with a blackish band from end muzzle to groin, margined with yellow below, from below eye to axilla. Pale yellow below, sides blackish spotted. Femora behind black, yellow veined. Limbs paler, rather closely cross-barred.

| | Lin. | | Lin. |
|---------------------------|------|------------------------------|------|
| Length head and body..... | 21·5 | Width head behind tympanum.. | 7·75 |
| " hind limb | 20· | Length hind foot | 14·5 |

1868.]

Three specimens (623) in Mus. Compar. Zoology, Cambridge, Mass. From near Rangoon, Burmah. With many other valuable specimens, these were procured by Wm. Theobald, Jr.

HYLORANA SUBCERULEA Cope, sp. nov.

Fourth toe somewhat more than half the length of the head and body. Two lateral glandular folds, the inferior much narrower, not reaching groin from angle mouth. No groove on the side of the belly. General form slender, the head elongate, the muzzle produced, 1.5 length of eye fissure, the nostril measuring two-fifths this distance. Tympanum .66 the diameter of eye. Interorbital width equal from eye to nostril. The middle of the metacarpus measures the end of the muzzle, as does the proximal two-fifths the tarsus. Skin above smooth except on posterior iliac region, where are small warts. Sides scarcely glandular. A delicate fold on tarsus; one metatarsal tubercle. Tongue rhombic, filling space between rami, contracted a little behind. Vomerine teeth in two rather long series originating at the front of the choanæ, and extend very obliquely backwards, and well separated. 1.3 phalanges of third and fifth toes free, and three phalanges of fourth toe.

Above glossy blue, sides with a blackish-blue band from end muzzle to groin. Dermal folds and a band all around the upper lip brassy yellow. Femora behind speckled and marbled with yellow on a blackish ground, and with a dark longitudinal band below; upper face tibia golden brown, not cross-barred. Arm not cross-barred. Everywhere below brown shaded, palest on the belly. In a younger specimen the belly is white and the upper surfaces pale brown.

| | Lin. | | Lin. |
|---------------------------|------|--------------------------|------|
| Length head and body..... | 15.1 | Length hind limb..... | 2.8 |
| “ tibia..... | 8 | “ to behind tympanum... | 6 |
| “ tarsus..... | 4.5 | Width at same point..... | 4.5 |
| “ foot..... | 8.25 | | |

This very handsome animal is nearest in general characters to the *H. macrodactyla* Günther, a specimen of which was procured at the same locality, viz.: Rangoon, Burmah, by Wm. Theobald, Jr., above recorded. Its feet are much less palmate than those of the *H. chalconota*, from Java, which it also resembles. It is one of the best illustrations of a genus which has been particularly furnished among the Batrachia with beauty of hue and lustre. Mus. Compar. Zoology (624—626), three specimens.

Sexual Law in ACER DASYCARPUM Ehrh.

BY THOMAS MEEHAN.

Noticing among the silver maple trees at Bristol, Pa., some trees which had evidently borne only pistillate flowers for many years, and had subsequently pushed forth branches which bore only male flowers, it occurred to me that possibly extended observations might enable me to discover the law which governed the production of male or female forms respectively. I afterwards examined carefully some thousands of trees in blossom, and though I failed in the immediate object, the discovery of the law, it may serve an useful purpose to place on record the facts observed in the investigation.

The staminate flowers are easily distinguished from the pistillate ones, not only by their larger size, owing to the development of the stamens, but by the pale yellowish-green of the filaments. The awl-shaped styles of the female flowers do not project far beyond the scales, and are reddish-brown. The Bristol trees were about a foot in diameter, very healthy, judging by their clean smooth bark, and had probably been in fruit-bearing condition for at least ten years. The proportion of male to female trees was about equal. There were many instances of branches with male flowers which had perhaps

[March,

within the last three or four years pushed out on trees which had evidently once borne only female ones; but in no instance did a female branch start out from a male tree. Having once begun to bear male flowers, these branches continued to develop these only, presenting the appearance of another variety grafted on another stock.

Returning to Philadelphia, noting every tree I met on the side-walks, I saw a very few trees which had male and female flowers scattered promiscuously over the same branches. These are very rare; but the fact of their existence may have an important bearing on any attempt to evolve the laws governing the production of separate sexes.

At Germantown I chose for the field of my investigation the large estate of Mrs. G. W. Carpenter, on which are many hundreds about twenty-five to thirty years old; but amongst all these I did not note one which showed any tendency to branch into distinct sexes like those at Bristol, or any one with mixed sexes like the few seen in Philadelphia. All the trees were either exclusively male, or exclusively female.

The parts of fructification in *Acer dasycarpum* have not, to my knowledge, been minutely described. It will be of interest, in connection with the subject of this paper, to note them.

There are three classes of buds on the tree: leaf-bearing, staminate, and pistillate. The leaf-bearing buds are formed of eight imbricated scales in four pairs, the scales all distinct and beneath the uppermost pair; five embryo leaves, rolled up to look very much like imperfect anthers, form a sort of crown. The bud bearing the staminate flower, or rather which forms it, has also eight scales, the upper two uniting for nearly half their length, and recurved at their summits when the flower is fully formed, making a cup-like involucre, at the bottom of which arise five (rarely seven) corollas, which are separated from each other at their bases by a fuscous down. These corollas are about one-fourth of an inch long, the lower half tubular, the upper half funnel-shaped, the five (rarely seven) stamens arising from the base of the funnel. The filaments are double the length of the corolla, which we may properly term it.

The female flower primarily resembles the other two in this, that it is composed of eight scales imbricated in pairs; but what in the male we call a corolla is reduced to a pair of united scales not more than one-thirty-second of an inch in depth, united into a flattened cup, with the edges rather inclined than to turn out. In the center is the two-styled ovary, and at its base arise seven stamens, although sometimes only four, generally five, push their anthers above the minute scaly cup outside. These anthers appear large and well-developed, but I have failed to find pollen in any one, and in no instance have I been able to find a perfect stamen like unto those formed in the staminate flower. These rudimentary stamens never push beyond the scales. Though classed as a Polygamous species by authors, it would appear from these observations a monœciously Dioecious plant.

In trying to classify my observations, in order to evolve some sexual law, I found that vigor made no difference; weak trees or weak branches were alike male or female. Some individuals are more years coming into flower than others. I fancied I had once got a clue in the fact that in the commencement of my observations I found numerous specimens of great size which were apparently commencing their fruiting age, and which were female trees in all cases; but at length I discovered two trees of the same character of the masculine kind.

The only positive fact in relation to the matter seems to be that the sexual character of the maple is not unchangable after the infancy of the tree; and that the tendency of development is from female to male.

1868.]

April 7th.

ISAAC LEA, LL.D., in the Chair.

Thirty-one members present.

The following was presented for publication: "Description of Sixteen new species of *Unio* of the United States." By Isaac Lea.

April 14th.

MR. VAUX, Vice President, in the Chair.

Twenty-nine members present.

April 21st.

MR. VAUX, Vice-President, in the Chair.

Twenty-four members present.

The following was presented for publication:

"Notes on some singular species of *Unio*." By Isaac Lea.

A letter from Mr. A. R. Roessler, dated Washington, April 18, was read, stating that he had examined a specimen of tin stone, from the vicinity of Ironton, Mo., and had found it to contain a "very favorable percentage of metal."

Dr. Genth remarked that he had examined specimens of the best tin ore of Missouri, and found that they contained only six pounds of tin to the ton of ore.

April 28th.

MR. JOS. JEANES in the Chair.

Forty-three members present.

The resignation of Mr. Samuel Jeanes, as a member of the Academy, was read and accepted.

The death of Mr. Isaac Barton was announced.

The following gentlemen were elected members: Dr. H. C. Chapman, Mr. Charles Wilson Peale, Mr. Benj. Bullock, Mr. Thos. Webster, and Dr. E. Dyer.

Dr. T. H. Turner, U.S.A., was elected a correspondent.

On favorable report of the committees, the following papers were ordered to be published:

On a New MINERAL in CRYOLITE.

BY THEO. D. RAND.

This mineral, for which I propose the name *Ivigtite*, from its locality, was first observed in 1866, but only recently has been obtained in sufficient quantity for examination.

It occurs disseminated in films and seams through massive cryolite—sometimes forming a coating between crystals of carbonate of iron and the cryolite in which the carbonate is imbedded. Color pale yellowish-green, some-

[April,

times yellow. Structure fine granular, approaching micaceous. Hardness 2—2·5 S. G. 2·05. B. B. alone blackens slightly and fuses rather easily to a white slag. With carb. soda fuses readily and with effervescence to a greenish bead. In borax dissolves readily iron reaction. In microcosmic salt dissolves readily, except silica skeleton, bead yellow while hot, bluish opalescent when cold. In closed tube yields acid water.

With considerable difficulty 0·679 gm. of the mineral, free from admixture, was obtained and submitted to analysis with the following percentage result :

| | |
|--------------------------|--------|
| Water..... | 3·42 |
| Fluorine..... | ·75 |
| Silica..... | 36·49 |
| Sesquioxide of iron..... | 7·54 |
| Alumina..... | 24·09 |
| Soda..... | 16·03 |
| Loss..... | 11·68 |
| | 100·00 |

The very small quantity of the mineral which could be procured prevented a more satisfactory result, but from the foregoing characteristics I feel justified in pronouncing it a new species, and hope that a larger quantity may be procured and a correct analysis made.

Pachnolite, besides its usual occurrence in honey-combed cryolite, nearly or always in juxtaposition with the so-called Hagemannite, has been observed in crystals implanted on massive cryolite, and also coating crystals of the latter, mixed with microscopic crystals of cryolite. The crystals of pachnolite are always small, rarely exceeding the fiftieth of an inch in diameter, but those of cryolite have been found measuring over 3-10ths of an inch cube. The crystals of carbonate of iron, found in the cryolite, have probably never been excelled for size and beauty. They are usually simple rhombohedrons, often of fine polish and measuring from half an inch to four inches across. A black blende, containing much iron, has been found in the massive cryolite, crystallized in perfect octahedra.

Philadelphia, March 23, 1868.

Description of Sixteen New Species of the Genus UNIO of the United States.

BY ISAAC LEA.

UNIO MURRAVENSI. — Testa lævi, obliqua, tumida, solida, valde inæquilaterali, postice rotundata, antice truncata; valvulis crassis, antice crassioribus; natibus valde elevatis, tumidis; epidermide luteo-fusca, concentricovittata, eradiata; dentibus cardinalibus crassis, subelevatis; lateralibus crassis, obliquis rectisque; margarita argentea et iridescente.

Hab.—Murray County, Georgia, Maj. T. C. Downie; Etowah River, Georgia, Bishop Elliott.

UNIO FASSINANS. — Testa lævi, elliptica, subcompressa, inæquilaterali, postice obtuse angulata, antice rotundata; valvulis crassiusculis, antice crassioribus; natibus subprominentibus; epidermide tenebroso-rufo-fusca, eradiata; dentibus cardinalibus crassiusculis, compressis, obliquis; lateralibus sublongis, crassis, obliquis corrugatisque; margarita salmonis colore tincta, splendida et iridescente.

Hab.—Headwaters of Holston River, Washington Co., Va., Prof. E. D. Cope.

UNIO SPARUS. — Testa lævi, lato-elliptica, subinflata, valde inæquilaterali, postice obtuse angulata, antice rotundata; valvulis subtenuibus, antice crassioribus; natibus prominulis, ad apices minute undulatis; epidermide subcrocea, valde radiata; dentibus cardinalibus parvis, erectis, conicis; laterali-1868.]

bus longis subcurvisque; margarita salmonis colore tincta et valde iridescente.

Hab.—Swamp Creek, North Georgia, Maj. T. C. Downie.

UNIO COPEI.—Testa lævi, elliptica, subcompressa, inæquilaterali, antice et postice rotundata; valvulis subcrassis antice crassioribus; natibus prominulis, ad apices undulatis; epidermide tenebroso-fusca, ad marginem squamosa, eradiata; dentibus cardinalibus subcrassis, elevatis, compressis, corrugatis, in utroque valvulo dupplicibus; lateralibus longis, lamellatis, subcurvatisque; margarita purpurea et valde iridescente.

Hab.—Headwaters of Holston River, Smith Co., Va., Prof. E. D. Cope.

UNIO CYLINDRELLUS.—Testa lævi, late elliptica, cylindracea, valde inæquilaterali, antice et postice rotundata; valvulis subcrassis, antice crassioribus; natibus prominulis; epidermide luteola, eradiata; dentibus cardinalibus parvis, subconicis corrugatisque; lateralibus longis subrectisque; margarita intus purpurea et valde iridescente.

Hab.—Duck Creek, Tenn.: Swamp Creek, Murray Co., Ga., Major Downie; and North Alabama, Prof Tuomey.

UNIO DIFFICILIS.—Testa lævi, elliptica, inflata, valde inæquilaterali, postice obtuse angulata, antice rotundata; valvulis tenuibus, antice crassioribus; natibus prominulis; epidermide luteola, valde radiata; dentibus cardinalibus parvisculis, conicis crenulatisque; lateralibus sublongis rectisque; margarita alba et valde iridescente.

Hab.—Swamp Creek, Ga., Major Downie; Holston River, Washington Co., Prof. Cope.

UNIO TOPEKAENSIS.—Testa lævi, lata, subcompressa, valde inæquilaterali, postice obtuse angulata, antice rotundata; valvulis crassiusculis, antice crassioribus; natibus prominulis, ad apices undulatis; epidermide tenebroso-fusca, radiata; dentibus cardinalibus erectis, compressis crenulatisque; lateralibus longis rectisque; margarita cæruleo-alba et valde iridescente.

Hab.—Topeka, Kansas, Prof. Daniels; Little Arkansas, Dr. Le Conte, &c.

UNIO BRAZOSSENSIS.—Testa plicata, subrotunda, ventricosa, valde inæquilaterali, antice et postice rotundata; valvulis percrassis, antice crassioribus; natibus prominentibus, tumidis, incurvis, ad apices minute undulatis; epidermide tenebroso-rufusca, eradiata; dentibus cardinalibus percrassis, solidis, erectis corrugatisque; lateralibus longis, subcrassis et obliquis; margarita argentea et valde iridescente.

Hab.—Dallas Co., Texas, Prof. Forshey; Brazos River, Dr. Lincecum.

UNIO LINCECUMII.—Testa plicata, rotundata, subglobosa, valde inæquilaterali; valvulis precrassis, antice crassioribus; natibus prominentibus, tumidis, incurvis, ad apices minute undulatis; epidermide tenebroso-fusca, nigricante, eradiata; dentibus cardinalibus percrassis, solidis, erectis corrugatisque; lateralibus longis, subcrassis et obliquis; margarita argentea et valde iridescente.

Hab.—Dallas County, Texas, Prof. Forshey; Brazos River, Texas, Dr. G. Lincecum.

UNIO CORVINUS.—Testa lævi, elliptica, inflata, valde inæquilaterali; antice et postice rotundata; valvulis subcrassis, antice crassioribus; natibus vix prominentibus, epidermide nigra, subsquamea, eradiata; dentibus cardinalibus parvissimis decussatisque; lateralibus longis subrectisque; margarita alba et valde iridescente.

Hab.—Flint River, Geo., J. C. Plant and Dr. Neisler; Neuse River, N. C., Prof. Emmons.

UNIO CORVUNCULUS.—Testa lævi, elliptica, subinflata, valde inæquilaterali; antice et postice rotundata; valvulis crassiusculis, antice crassioribus; nati-

[April,

bus prominulis, ad apices subconcentrico-undulatis; epidermide nigricante, eradiata; dentibus cardinalibus parvis, erectis, subcompressis crenulatisque; margarita purpurea et iridescente.

Hab.—Flint River, Ga., J. C. Plant and Dr. Neisler; Darien, J. H. Couper.

UNIO PLANIOR.—Testa subsulcata, subtriangulari, ad latere planulata, inæquilaterali; valvulis crassiusculis, antice crassioribus; natibus subprominentibus; epidermide vel lutea vel ochracea, radiata; dentibus cardinalibus parvis, compressis striatisque; lateralibus longis, crassiusculis et obliquis; margarita alba et iridescente.

Hab.—Tennessee, Mr. H. Moores; Headwaters Holston River, Washington Co., Virginia, Prof. Cope.

UNIO VALLATUS.—Testa nodulosa, rotundata, lenticulari, subinflata, inæquilaterali; valvulis, crassis, antice crassioribus; natibus subprominentibus; epidermide luteo-fusca, eradiata; dentibus cardinalibus pergrandibus, elevatis granulatisque; lateralibus crassis, curtis obliquisque; margarita argentea et iridescente.

Hab.—Alabama River, Dr. Showalter.

UNIO REFULGENS.—Testa nodulosa, rotundata, lenticulari, inæquilaterali; valvulis subcrassis, antice crassioribus; natibus prominulis; epidermide rufo-castanea, aliquanto polita; dentibus cardinalibus subgrandibus, elegantè corrugatis crenulatisque; lateralibus longiusculis, obliquis, minute corrugatis; margarita albida, ad marginem purpurecente et elegantissime iridescente.

Hab.—Oktibbeha River, Lauderdale Co., Miss., W. Spillman, M. D.

UNIO UHARENSIS.—Testa lævi, oblonga, ad latere planulata, inæquilaterali, postice biangulata, antice rotundata; valvulis crassiusculis, antice crassioribus; natibus prominulis; epidermide rufo-fusca, subsquamea, eradiata; dentibus cardinalibus parvis, striatis, in utroque valvulo duplicibus; lateralibus longis, lamellatis subcurvisque; margarita vel alba vel salmonis colore tincta.

Hab.—Uharee River, Montgomery Co., N. C., F. A. Genth, M. D.

UNIO SPHÆRICUS.—Testa nodulosa, valde inflata, subglobosa, fere æquilaterali; valvulis crassis, antice crassioribus; natibus elevatis; epidermide rufo-castanea, eradiata; dentibus cardinalibus pergrandibus, corrugatis crenulatisque; lateralibus curtis, crassis, corrugatis, obliquis subcurvisque; margarita argentea et valde iridescente.

Hab.—Pearl River, at Jackson, Miss., C. M. Wheatley.

Notes on some singular forms of Chinese species of *UNIO*.

BY ISAAC LEA.

In a paper on "Chinese Shells," by Dr. Baird and Mr. H. Adams, published in the Proceedings of the Zoological Society of London, May 9, 1867, there are some remarks and claims which call upon me for correction.

1st, "*Unio Douglasiæ*." It is stated that "in 1833 Dr. Gray shortly described and accurately figured in the 12th volume of Griffith's edition of Cuvier a species of *Unio*, which he called *U. Douglasiæ*," &c. Further, that "Mr. Lea, some years afterwards, from not knowing the shell as figured in Griffith, described and figured a species from China, which he named *U. Murchisonianus*, but which there is no doubt is the same as *U. Douglasiæ* of Gray." In the above statements there are several to which I beg leave to demur. It is suggested by these gentlemen that "perhaps from not knowing the shell (*Douglasiæ*) as figured in Griffith," I had "described and figured *Murchisonianus*, which there is no doubt is the *Douglasiæ* of Gray." In answer to this I 1868.]

would ask how I could, when I read my paper on the 16th March, 1832, before the American Philosophical Society, know of a description in Griffith's Cuvier dated 1834? (not in 1833, as incorrectly cited). *Douglasia* therefore cannot have precedence "of some years," as claimed for it, but it must remain a synonym to *Murchisonianus*, where I placed it in my *Synopsis*, first, second, and third editions, since 1836.

As regards the claim in the same paragraph for *U. Shanghaiensis*, Lea, being also a synonym to *Douglasia*, I am constrained to differ in opinion. *Shanghaiensis* is not the same with *Douglasia*, as affirmed, but it is the same with *U. Osbeckii*, Philippi, the description of which I had not seen. "Conchylien, vol. 3d." Some years since I placed it as a synonym to *Osbeckii* in the manuscript copy of my *Synopsis*, 4th ed., preparing for the press.

2d. *Anodonta tenuis*, Gray,—also called *Unio tenuis*, Gray, in Griffith's Cuvier,—is considered to be, by Messrs. Baird and Adams, an *Anodonta*, and it is said to be little known. This shell does not belong to either of these genera. It is a true *Dipsas* of Leach, and if Dr. Gray had had a perfect specimen before him when describing *Anodonta tenuis*, he never would have placed it in that genus. The *Dipsasian* character was evidently obliterated by age in the specimen from which he made his diagnosis. The young specimens, and the mature perfect ones, always have the tooth (so to call it) of the genus *Dipsas*. I described this species in the Transactions of the American Philosophical Society, March 15, 1833, under the name of *Symphynota discoidea*, with a figure perfectly representing the characteristic tooth, which consists of a single raised, slightly curved line under the dorsal margin. In my "Synopsis," in the first edition in 1836, as well as in the second and third editions, I gave Dr. Gray's *tenuis* as a synonym to this shell, which I there placed in the genus *Dipsas*, where it properly belongs. It must therefore stand as *Dipsos discoidea*, Lea, with the synonym of *Anodonta tenuis*, Gray; my date being 1833, and Dr. Gray's 1834.

In this paper of Messrs. Baird and Adams, they have described a supposed new species from Shanghai, under the name of *Unio (Lampsilis) subtortus*. I previously published a description of a species which I believe will prove the same, under the name of *tortuosus*, in the Proc. Acad. Nat. Sci. April 18, 1865. Since then I have found in the "Journal de Conchiliologie," July, 1863,—which work for that year was not accessible to me,—that Messrs. Crosse and Debeaux had given a description and an excellent figure of a *Unio* of the same twisted character, under the name of *Tientsinensis*, which, if the figure be entirely correct, differs in the form of the posterior slope, and in the undulations of that part.

I may be permitted to express my surprise that neither the French nor the English authors should have observed the very remarkable character of these Chinese species, which were before them, in being *inequivalve*! The figure in the *Journal de Conchylologie* seems to be very correctly delineated by the artist, having represented the *inequivalve* condition of the right and left valves.

Messrs. Baird and Adams refer to *Tientsinensis*, but consider it to differ in some respects from their *subtortus*, which I think very likely. If *Tientsinensis* prove to be the same as *tortuosus* and *contortus*, then the two last must be synonyms. If not, then there will be two species, viz.: *Tientsinensis*, Grosse and Debeaux, and *tortuosus* (nobis),—*contortus*, B. and A., being a synonym to *tortuosus*.

May 5th.

MR. VAUX, Vice-President, in the Chair.

Twenty-nine members present.

The following paper was presented for publication: "List of
[May,

Birds collected at Laredo, Texas, in 1866 and 1867." By Dr. H. B. Butcher.

May 12th.

MR. VAUX, Vice-President, in the Chair.

Thirty-six members present.

The following were presented for publication: "Description of Four new species of Exotic Unionidæ," and "Description of Twenty-six new species of Melanidæ of the United States." By Isaac Lea, LL.D.

"Monœcism in *Luzula campestris*," and "Variations in *Epigea repens*." By Thos. Meehan.

Prof. Edw. D. Cope defined the characters of a new genus of Cheloniidæ, which represented the modern marine turtles in the Cretaceous green sand of New Jersey. It differed in the considerably greater co-ossification of the disc and marginal bones posteriorly and anteriorly. The anterior rib is attached to one marginal in advance of that to which it is connected in *Chelone*. He called it *Ostronygis*, and exhibited a specimen of the type species—*O. emarginatus* Cope—of which about half the carapace and plastron were preserved, and which indicated an animal of about the size of the green turtle. It was presented to the Academy by Dr. Samuel Ashburst.

Prof. Cope stated that he was more or less acquainted with four species of the genus: *O. sopitus* (*Chelone* Leidy), *O. chelydrinus* Cope, and *O. repandus* Cope, all of the same or larger size than the type.

May 19th.

MR. VAUX, Vice-President, in the Chair.

Twenty-nine members present.

Prof. Cope called attention of the Academy to the rarity of Ophidian remains, and to the fact that none had been discovered in North America up to the present time. He then exhibited two vertebræ of a serpent of or near the family of the Boas, from the green sand of Squankum, Monmouth Co., N. J., which had been discovered by Dr. Knieskern.

Peculiar interest attached to these specimens, from the fact that they came from a bed which has recently been stated, by Conrad, to be an equivalent of the older Eocene or London clay of the Thames valley. They confirm this identification exactly, since they belong to Owen's genus *Palæophis*, which is characteristic of those beds in England. They indicate a species intermediate between the two larger described by Prof. Owen, and of some fifteen feet in length. It was associated with remains of crocodiles, sting-rays and saw-fishes, and was named, from its geographical and geological location, *PALÆOPHIS LITTORALIS* Cope.

The type specimens belong to the Geological Survey of New Jersey, under Prof. George Cook, and were lent by him for description.

Dr. Hayden read a letter from Prof. Leo Lesquereux, identifying the fossil plants of the coal formation of the south-west, as follows:

"I was unwell when your boxes of fossil plants arrived, and was not able to examine the specimens before now.

1868.]

"Most of the leaves, which are well preserved indeed, belong to a new species of *Ficus*. It resembles *Ficus lanceolatus*, Heer., a miocene species, but differs by leaves being broader, mostly rounded at base, and not *always* alternated to the petiole. The medial nerves and shorter pedicel are thicker. Some of the leaves, which are narrower and narrowed to the petiole, present the form and appearance of *Ficus lanceolatus*, but the specific difference is marked by the thick nerves and shorter petiole.

"Among these leaves there are two fragments of leaves of a *Cinnamomum*, referable perhaps to *C. affine*, Lesqx.; a large leaf of *Platanus*, probably *P. aceroides*? Aug., whose borders are destroyed, and a *Populus* with round leaves—*Populus subrotundus*, Lesqx.—found also by Dr. Hayden at Rock Creek.

"Besides these species, the specimens show a number of fragments of a *Cyperus*, apparently a new species. The nervation is that of *Cyperus charnensis*, Heer., but the leaves, $1\frac{1}{2}$ inches broad, are twice as broad as in the European species."

Dr. Hayden considered this as confirming his opinion that the lignite beds of that region were of tertiary age.

Dr. Le Conte said that the question of the geological age of that section must be solved by a consideration of the relative positions of the strata, rather than by comparison of the fossil plants found therein.

May 26th.

MR. CASSIN, Vice-President, in the Chair.

Thirty-nine members present.

The following gentlemen were elected members: Mr. Edward Lewis, Jas. Truman, M.D., Wm. Trueman, M.D., Mr. S. Fisher Corlies, Mr. T. W. Starr, Edw. Rhoads, M.D., T. H. Andrews, M.D., Herbert Norris, M.D., Mr. Jas. S. Gilliams, Mr. Charles Bullock, Mr. Edw. L. Huit, Mr. I. Zentmayer, Mr. Aug. F. Müller, F. F. Maury, M.D., Horace Williams, M.D., Mr. Wm. H. Walmsley, Mr. T. L. Buckingham.

The following were elected correspondents: Mr. Augustus Fendler, of Allenton, Mo.; Hon. J. S. Wilson, of Washington, D.C.; Mr. A. R. Roesler, Washington, D. C.; Prof. John Tomes, F.R.S., of London.

On favorable reports of the committees, the following papers were ordered to be published:

List of BIRDS collected at Laredo, Texas, in 1866 and 1867.

BY H. B. BUTCHER, M. D.

The list of birds here given embraces the species collected by me at Laredo, Texas, on the Rio Grande river, while engaged as Acting Assistant Surgeon of the U. S. Army; and is presented as a contribution to the subject of the geographical distribution of the birds of North America. No new species but many quite rare species were procured. The most interesting result of my examinations at Laredo was the discovery in abundance of *Scardafella inca*, a species not previously obtained north of the Rio Grande.

The collections made were first sent to the Smithsonian Institution, and a series afterwards presented to this Academy. I am indebted to Prof. Baird for assistance in identifying the species.

A comparison of this list with that of the birds collected in Texas by Mr. Dresser will be found of interest.

[May,

- Tinnunculus sparverius*, *Vieill.* Nov., Jan. and Feb.
Accipiter fuscus, *Bonap.* Jan.
Buteo swainsoni, *Bonap.* July.
Buteo borealis, *Vieill.* Jan.
Polyborus Audubonii, *Cassin.* Jan.
Athene hypugæa, *Bonap.* Oct., Jan.
Bubo virginianus, *Bonap.* Oct.
Geococcyx californianus, *Baird.* May to Sept. Abundant.
Coccyzus erythrophthalmus, *Bp.* June to Aug.
Picus scalaris, *Wagler.* June to Nov. Abundant.
Centurus flaviventris, *Sw.* June to Nov. Abundant.
Antrostomus nuttalli, *Cassin.* Sept., Feb.
Chordeiles texensis, *Laur.* May to Sept.
Ceryle alcyon, *Boie.* Oct.
Tyrannus verticalis, *Say.* May.
Myiarchus crinitus, *Cab.* Aug. and Sept.
Myiarchus mexicanus, *Baird.* Aug.
Sayornis fuscus, *Baird.* Nov.
Sayornis sayus, *Baird.* Nov., Jan., Feb.
Contopus virens, *Cab.* May.
Empidonax pusillus, *Cab.* May.
Empidonax flaviventris, *Baird.* Aug.
Turdus migratorius, *Lin.* Jan.
Sialia sialis, *Baird.* Nov.
Sialia arctica, *Swains.* Feb.
Anthus ludovicianus, *Licht.* Nov., Dec.
Regulus calendula, *Licht.* Dec., Feb.
Geothlypis philadelphia, *Baird.* Sept.
Helminthophaga celata, *Baird.* Nov., Jan., Feb.
Dendroica æstiva, *Baird.* May, Aug., Sept.
Dendroica coronata, *Gray.* Dec., Jan.
Myiodioctes pusillus, *Bonap.* Sept.
Pyranga æstiva, *Vieill.* Aug.
Cotyle serripennis, *Boie.* May, June, March.
Ampelis cedrorum, *Baird.* March.
Collyrio excubitoroides, *Baird.* April and Sept. to Nov., Jan., Feb.
Vireo gilvus, *Bonap.* May.
Vireo belli, *Aud.* May, June, Aug.
Mimus polyglottus, *Boie.* April to Oct., Dec. to Feb.
Oreoscoptes montanus, *Baird.* April, May to Nov., Dec. to March. Abundant.
Harporhynchus curvirostris, *Cassin.* April to Nov., Feb. Abundant.
Harporhynchus longirostris, *Cassin.* May, Nov., Jan.
Campylorhynchus brunneicapillus, *Gray.* May, June, Nov., Feb.
Salpinctes obsoletus, *Cab.* May, Nov., Oct., Dec., Feb.
Thryothorus bewickii, *Bonap.* Nov. to Feb.
Poliophtila cærulea, *Sclat.* July, Aug., Oct.
Lophophanes atricristatus, *Cass.* Aug., Nov.
Paroides flaviceps, *Baird.* May to Sept., Jan., Feb. Abundant.
Eremophila cornuta, *Boie.* Nov., Dec.
Chrysomitris tristis, *Bonap.* Dec.
Electrophanes macdonnii, *Laur.* Dec.
Chondestes grammacus, *Bonap.* April, Sept. to Nov. Abundant.
Zonotrichia leucophrys, *Sw.* April, Dec. to Feb.
Zonotrichia gambelii, *Gambel.* Jan.
Poospiza bilineata, *Sclat.* June to Oct. Abundant.
Melospiza heermanni, *Baird.* Jan.
Peucaea cassini, *Baird.* June.
Melospiza lincolni, *Baird.* Dec.

1868.]

Embernagra rufivirgata, *Laur.* Nov.
Calamospiza bicolor, *Bonap.* Nov.
Euspiza americana, *Bonap.* Aug.
Guiraca cærulea, *Sw.* May, June, Oct.
Cyanospiza ciris, *Baird.* April to Aug. Abundant.
Pyrrhuloxia sinuata, *Bonap.* April to Sept., Dec. to Feb. Abundant.
Cardinalis virginianus, *Bonap.* May to Aug., Nov., Dec. Abundant.
Pipilo chlorura, *Baird.* Dec., Jan.
Molothrus pecoris, *Sw.* April to July, Jan. Abundant.
Xanthocephalus icterocephalus. April, May.
Sturnella neglecta, *Aud.* Oct. and Nov. Abundant.
Sturnella magna, *Sw.* Dec.
Icterus cucullatus, *Sw.* June.
Icterus spurius, *Bonap.* June, Aug.
Icterus bullockii, *Bonap.* May to Aug. Abundant.
Scolecophagus cyanocephalus, *Sw.* Nov., Feb.
Quiscalus macroura, *Sw.* June.
Corvus cryptoleucus, *Couch.* Feb., March.
Zenaidura carolinensis, *Bonap.* April to July.
Scardafella inca, *Bonap.* May, Sept. to Nov., Dec., Feb., March. Abundant.
Ortyx texanus, *Laur.* Oct., Nov., Dec.
Callipepla squamata, *Gray.* April to Nov., Feb. Abundant.
Grus canadensis, *Temm.* Jan.
Ardea herodias, *Linn.* Jan.
Nyctherodius violaceus, *Reich.* Sept.
Aegialitis vociferus, *Cass.* April, May, Aug., Sept.
Tringa wilsonii, *Nuttall.* Oct., Dec.
Ereunetes petrificatus, *Ill.*
Actiturus bartramius, *Bonap.* Aug.
Tringites rufescens, *Cab.*
Pelecanus fuscus, *Linn.* May.

Descriptions of four new species of Exotic UNIONIDÆ.

BY ISAAC LEA.

ANODONTA STREBELII.—Testa lævi, elliptica, inæquilaterali, postice obtuse angulata, antice rotundata; valvulis pertenuibus; natibus prominulis; epidermide tenebroso-viridi, radiis capillaris indutis; margarita cærulea et valde iridescente.

Hab.—Vera Cruz, Mexico; Dr. G. Strebel, per Smithsonian Institution.

UNIO VERACRUZENSIS.—Testa lævi, elliptica, subcompressa, inæquilaterali, postice obtuse angulata, antice rotundata; valvulis tenuibus; natibus prominulis; epidermide tenebroso-fusca, radiata politaque; dentibus cardinalibus parvis, compressis, crenulatis, in utroque valvulo duplicibus; lateralibus longis, rectis lamellatisque; margarita cærulea et valde iridescente.

Hab.—Vera Cruz, Mexico; Dr. G. Strebel, per Smithsonian Institution.

UNIO PRUNOIDES.—Testa lævi, elliptica, valde ventricosa, inæquilaterali, antice et postice rotundata; valvulis subcrassis, antice aliquanto crassioribus; natibus prominulis; epidermide tenebroso-fusca, eradiata; dentibus cardinalibus compressis, obliquis et valde crenulatis; lateralibus longis, lamellatis corrugatisque; margarita argentea.

UNIO CHINENSIS.—Testa nodulosa, subelliptica, inflata, fere æquilaterali, postice obtuse angulata, antice rotundata; valvulis crassiusculis, antice crassioribus; natibus subprominentibus, ad apices corrugatis; epidermide virido-lutea, radiis viridis undique indutis; dentibus cardinalibus erectis, compressis, striatis, crenulatis et in utroque valvulo subduplicibus; lateralibus sublongis subrectisque; margarita argentea et valde iridescente.

[May,

Descriptions of Twenty-six New Species of MELANIDÆ of the United States.

BY ISAAC LEA.

GONIOBASIS WHEATLEYI.—Testa striata, subfusiformi, subinflata, subcrassa, ochracea, vel vittata vel evittata; spira conoidea, ad apicem aliquanto plicata; suturis irregulariter impressis; anfractibus instar senis, fere planulatis; apertura subconstricta; ovata, intus ochracea; labro acuto, parum sinuoso; columella inflecta, reflexa et tortuosa.

Hab.—Coosa River, Alabama, Dr. Showalter.

GONIOBASIS SIMILIS.—Testa striata, subfusiformi, subtenui, luteo-cornea; spira brevi, ad apicem plicata; suturis impressis; anfractibus instar senis, vix convexis; apertura subgrandi, ovata, intus luteo-alba; labro acuto; columella inflecta et tortuosa.

Hab.—Connesauga Creek, Georgia, Major T. C. Downie.

GONIOBASIS SULCATA.—Testa striata, conica, subcrassa, mellea, evittata; spira obtusa; suturis irregulariter impressis; anfractibus instar septenis, planulatis, ad apicem carinatis et plicatis; apertura parviuscula, rhomboidea, intus alba, labro acuto, sinuoso; columella inflecta, incrassata.

Hab.—Cahawba River, Alabama, Dr. Showalter.

GONIOBASIS ARATA.—Testa valde striata, conoidea, subtenui, cornea, vel vittata vel evittata; spira elevata; suturis impressis; anfractibus septenis, planulatis, ad apicem carinatis et plicatis; apertura parva, ovata, intus albida; labro aliquanto crenulato; columella inflecta, ad basim retrorsa.

Hab.—Connesauga Creek, Georgia, Maj. T. C. Downie.

GONIOBASIS GESNERII.—Testa striata, fusiformi, tenui, tenebroso-oliva; spira subbrevis; suturis impressis; anfractibus instar septenis, planulatis; apertura grandi, late ovata, intus lugubri; labro acuto, parum sinuoso; columella purpurescens et valde contorta.

Hab.—Uchee River, Alabama, Mr. W. Gesner.

GONIOBASIS TENEBROSA.—Testa valde striata, subfusiformi, subcrassa, tenebrosa; spira brevi; suturis irregulariter impressis; anfractibus instar quinis, vix convexis; apertura grandi, ovata, intus tenebroso-purpurea; labro subcrenulato; columella inflecta et parum contorta.

Hab.—Connesauga Creek, Georgia, Maj. T. C. Downie.

GONIOBASIS BIFASCIATA.—Testa plicata, aliquanto striata, subcrassa, luteola, bifasciata; spira obtusa, valde plicata; suturis irregulariter impressis; anfractibus instar senis, planulatis; apertura parviuscula, subrotunda, intus albida; labro acuto, parum sinuoso; columella albida et contorta.

Hab.—Jackson Co., Alabama, Dr. Spillman.

GONIOBASIS CLATHRATA.—Testa plicata et striata, pyramidata, tenui, dilute cornea, efasciata; spira exerta, acuminata; suturis impressis; anfractibus octonis, convexiusculis; apertura parviuscula, rhomboidea, intus vel albida vel purpurea; labro crenulato, subsinuoso; columella valde contorta.

Hab.—Jackson Co., Alabama, Dr. Spillman.

GONIOBASIS PULCHELLA.—Testa plicata, subturrita, subtenui, rufo-cornea, vittata; spira elevata; suturis irregulariter impressis; anfractibus instar novenis, convexiusculis; apertura parviuscula, ovata, intus albida; labro acuto; columella inflecta et tortuosa.

Hab.—North Alabama, Dr. Spillman.

GONIOBASIS LUTEOCELLA.—Testa plicata et striata, fusiformi, subcrassa, ochracea, vittata vel evittata; spira brevi; suturis irregulariter impressis; anfractibus quinis, convexiusculis; apertura grandi, ovata, intus luteo-alba; labro acuto; columella superne incrassata et valde contorta.

Hab.—Connesauga Creek, Georgia, Maj. T. C. Downie.

GONIOBASIS CONNESSAUGAENSIS.—Testa plicata, inferne striata, subfusiformi, subtenui, vel mellea vel ochracea vel tenebroso-fusca, nitida; spira conoidea; suturis impressis; anfractibus septenis, planulatis; apertura subconstricta, rhomboidea, intus luteola vel tenebroso-fusca; labro acuto; columella inflecta et tortuosa.

Hab.—Connesauga Creek, Georgia, Maj. T. C. Downie.

GONIOBASIS CONTIGUA.—Testa lævi, subfusiformi, tenui, tenebroso-oliva, evittata; spira subelevata; suturis impressis; anfractibus instar quinis. convexiusculis; apertura grandi, subrhombica, intus albida; labro acuto, sinuoso; columella vix incrassata et valde contorta.

Hab.—Connesauga Creek, Georgia, Maj. T. C. Downie.

GONIOBASIS MURRAYENSIS.—Testa lævi, fusiformi, inflata, subtenui, tenebroso-cornea, evittata; spira conoidea, ad apicem plicata; suturis aliquanto impressis; anfractibus instar senis, subplanulatis; apertura magna, subrhomboidea, intus luteola; labro acuto, parum sinuoso; columella inflecta et tortuosa.

Hab.—Swamp Creek, Murray Co., Ga., Maj. T. C. Downie.

GONIOBASIS GRANATOIDES.—Testa granulata, inferne striata, subfusiformi, subtenui, cornea; spira conoidea, ad apicem plicata; suturis impressis; anfractibus instar senis, vix convexis; apertura subgrandi, ovata, intus luteo-alba; labro acuto; columella tortuosa.

Hab.—Connesauga Creek, Georgia, Maj. T. C. Downie.

GONIOBASIS CLAVULA.—Testa carinata, aliquanto plicata, tenui, tenebroso-castanea, efasciata; spira exerta, acuminata; suturis regulariter impressis; anfractibus instar octonis, planulatis; apertura parvissima, ovata, intus castanea; labro acuto; columella alba et contorta.

Hab.—Jackson Co., Alabama, Dr. Spillman.

GONIOBASIS COCHLIARIS.—Testa carinata et striata, cylindracea, tenui, tenebroso-fusca, evittata; spira attenuata; suturis valde impressis; anfractibus instar novenis, ad apicem valde carinatis, inferne striatis; apertura parvissima, late elliptica, intus tenebroso; labro subcrenato; columella inflecta, ad basim incrassata.

Hab.—Shelby Co., Alabama, Maj. T. C. Downie.

GONIOBASIS VENUSTA.—Testa subcarinata, conoidea, subtenui, mellea, evittata; spira elevata; suturis regulariter impressis; anfractibus planulatis, instar septenis; apertura parva, rhomboidea, intus albida; labro acuto; columella inflecta et valde contorta.

Hab.—Coosa River, Alabama, Dr. Showalter.

GONIOBASIS ORNATA.—Testa carinata, subturrita, tenui, olivacea, valde vitata; spira elevata, superne plicata; suturis valde impressis; anfractibus septenis, planulatis; apertura parviuscula, subrhomboidea, intus vittata; labro acuto, aliquanto sinuoso; columella vix incrassata et valde contorta.

Hab.—Connesauga Creek, Georgia, Maj. T. C. Downie.

TRYPANOSTOMA NUCIFORME.—Testa lævi, obtuse conica, inflata, crassiuscula, castanea; spira brevi, obtusa; suturis regulariter impressis; anfractibus instar quinis, convexiusculis; apertura magna, rhomboidea; labro acuto; expanso, sinuoso; columella inflecta et valde tortuosa.

Hab.—Connesauga Creek, Georgia, Maj. T. C. Downie.

TRYPANOSTOMA CASTANEUM.—Testa lævi, pyramidata, subtenui, castanea, obsolete fasciata; spira exerta, acuminata; suturis impressis; anfractibus instar novenis, planulatis; apertura parviuscula, rhomboidea, intus dilute purpurea; labro acuto, sigmoideo; columella parum incrassata et valde contorta.

Hab.—Coosa River, Alabama, Dr. Showalter.

TRYPANOSTOMA WHEATLEYI.—Testa lævi, pyramidata, tenui, dilute rubiginosa, vel fasciata vel efasciata; spira exserta, acuminata; suturis regulariter impressis; anfractibus instar denis; planulatis, ad apicem carinatis; apertura parviuscula, rhomboidea, intus albida; labro acuto, sigmoideo; columella ad basim parum incrassata et valde contorta.

Hab.—Coosa River, Alabama, Dr. Showalter.

TRYPANOSTOMA TERREBRE.—Testa lævi, pyramidata, tenui, olivacea, vel vittata vel evittata; spira valde exserta; suturis valde impressis; anfractibus instar duodenis, planulatis, ad apicem carinatis; apertura parviuscula, rhomboidea, intus albida vel vittata; labro acuto, sinuoso; columella impressa et valde contorta.

Hab.—Jackson Co., Alabama, Dr. W. Spillman.

LITHASIA PURPUREA.—Testa lævi, curta, subcylindracea, subcrassa, tenebroso-purpurea; spira brevissima; suturis valde impressis; anfractibus instar quinis, convexiusculis; apertura grandi, rhomboidea, intus saturale purpurea; labro acuto, vix sinuoso; columella impressa, superne incrassata.

Hab.—Cahawba River, at Centreville, Bibb Co., Ala., Dr. Showalter.

LITHASIA CURTA.—Testa granulata, curta, solida, luteo-olivacea, plerumque bifasciata; spira brevi; suturis irregulariter impressis; anfractibus instar quinis, planulatis; apertura subgrandi, rhomboidea, intus albida; labro acuto, subsinuoso; columella inferne et superne incrassata.

Hab.—North Alabama, Prof. Tuomey and Dr. Spillman; Tuscumbia, B. Pybus.

SCHIZOSTOMA WHEATLEYI.—Testa striata, subfusiformi, subtenui, luteola, imperforata, vittata; spira obtuso-conoidea; suturis irregulariter impressis; anfractibus instar senis, vittatis, ultimo grandi; fissura obliqua brevique; apertura parviuscula, ovata, intus alba et vittata; labro subcrenulato; columella alba, incrassata et contorta.

Hab.—Coosa River, Dr. Showalter.

ANCULOSA DOWNIEI.—Testa plicata et obsolete striata, subglobosa, crassa, tenebroso-oliva, maculata; spira vix prominulis, plicatis; suturis impressis; anfractibus vix ternis, ultimo grandi et ventricosus; apertura grandi, subrotunda, intus fusco-maculata; labro acuto; columella impressa et incrassata.

Hab.—Connesauga Creek, Georgia, Maj. T. C. Downie; Coosa River, Alabama, Dr. Showalter.

Variations in *EPIGEA REPENS*.

BY THOMAS MEEHAN.

There are yet many botanists who regard variations as accidents. They speak of a normal form as something essential; and departures from their idea of a type, they refer to external causes, independent of any inherent power of change in the plant itself. Hence, when a change of form occurs to them, it is usually referred to shade, to sunlight, to an unusual season, situation, or some geological peculiarity of the soil. Cultivation is denounced as interfering with botanical science; introducing and originating innumerable forms, defying the skill of the botanist to classify or arrange. My experience in plant culture, and as an observer of plants in a state of nature, leads to the conclusion that there is no greater power to vary in the one case than in the other; that there is as much variation in the perfectly wild plant, as in those under the best gardener's skill. To illustrate this I gathered a great number of specimens of *Antennaria plantaginifolia*, which, though I do not believe has a greater average power of variation than any other plant, affords a good example for the following reasons: The small seeds I believe require a clear surface of

ground to vegetate, and young plants therefore never appear in a meadow or grassy place. In such positions plants only exist that had a footing in advance of the grass. They then propagate exclusively by runners. After being two or three years in this situation they form patches of one or several square feet each. Now it is not easy to appreciate a minute difference between one single specimen and another; but when a score or more of specimens of one are matched against a similar number of the other, the minutiae make an aggregate which is readily estimated. So we shall find in the case of a two or three year old meadow, filled with this plant, that not only are *no two patches alike*, but that the eye convinces us of the fact on the first glance over the field. Plain as the differences thus presented were, I found, however, some difficulty in describing them in language; and besides being a diœcious plant there might be brought in the objection of intercrossing between allied species of this or neighboring genera, if not of the individuals of the opposite sexes themselves, to account for so many forms. I therefore chose *Epigæa*, as belonging to a natural order exclusively hermaphrodite; containing only one natural species; not very closely allied to any of the neighboring genera, *Andromeda*, *Clethra*, *Gaultheria*, &c.; none of which, at any rate, flower at the same time with it.

On the 19th of April I gathered specimens from sixteen different plants on the Wissahickon, without taking any pains to make any particular selection of varieties. The following descriptions show their variations:

1. Tube of the corolla half inch long, contracted in the middle; segments of the corolla broadly ovate, one-third the length of the tube, incurved, pure white. Scales of the calyx two-thirds the length of the tube, narrowly lanceolate, interior ones white and membranaceous with a crimson base.

2. Tube half inch, regularly cylindrical; segments half as long as the tube, triangularly ovate, light rose, incurved. Scales one-third the length of the tube, white, coriaceous.

3. Tube quarter inch, thick (one-eighth wide), cylindrical; segments rather longer than the tube, triangularly ovate, incurved, deep rosy pink. Scales three-fourths the length of the tube, rosy red, with white margins.

4. Tube nearly half inch, contracted at the summit; segments very short, scarcely one-sixteenth of an inch, forming nearly five ovate repand teeth, purplish white. Scales greenish white, simply acute.

5. Tube quarter inch long, one-eighth wide; segments lanceolate, erect, two-thirds as long as the tube, rosy purple. Scales brown, not margined, drawn out to a long fine point.

6. Tube quarter inch, cylindrical; segments oblong ovate, recurved, as long as the tube. One of the anthers slightly petaloid. Scales prolonged into almost an awn.

7. Tube much narrowed at the summit, quarter inch long; segments less than one-sixteenth of an inch long, pale purple. Scales greenish brown, very narrow.

8. Tube near half inch, contracted in the middle; segments quarter inch, linear lanceolate, bright rose. Scales half the length of the tube, broadly ovate, membranaceous, simply sharp pointed.

9. Tube half inch, cylindrical; segments quarter inch, of which there are but three broadly ovate, white.

10. Tube nearly three-quarters inch, cylindrical; segments quarter inch, narrowly ovate. Scales as long as the tube, linear lanceolate, pale green.

11. Tube less than quarter inch, and shorter than the luxuriant foliaceous, mucronate scales. Segments of the corolla two-thirds as long as the tube, broadly ovate, pure white.

12. Tube quarter inch, increasing slightly in width upwardly (funnel-shaped), one-eighth thick at the top of the tube; segments short, ovate, reflexed, light pink. Scales longer than the tube, green, white margined.

13. Tube quarter inch, much contracted in the middle; segments quarter

[May

inch, broad ovate. Scales half the length of the tube, brown, with white margins.

14. Tube under half inch, thick, perfectly cylindrical; segments quarter inch, broad linear, and rounded at the apex, waxy white. Scales quarter inch long, brown, with membranaceous margins.

15. Tube full three-quarters inch, cylindrical; segments quarter inch, triangularly ovate, pale rose. Scales half inch, narrow and drawn out to an awn-like point.

16. Tube half inch, cylindrical. Scales less than one-sixteenth of an inch, broad ovate, green, and barely pointed.

On again examining No. 12, after making these notes, I was surprised to find no trace of stamens, but with the pistil perfect; and on examining the other specimens I found three out of the fifteen were pistillate also. Another remarkable fact was that all these pistils had the fine cleft stigmas strongly recurved, exposing a glutinous surface; while the hermaphrodite ones kept the apex of the pistils closed. The ovaries of the pistillate forms were also evidently better developed than those in the hermaphrodite condition, and the inference was that the plant was *practically dioecious*.

On the third of May I returned to the locality and found this hypothesis in all probability correct. The pistillate plants were in proportion about one-third that of the hermaphrodite, and could be readily distinguished after the flower had faded by the recurved stigmas above noted. All the plants that had shed their corollas were pistillate; the apparently hermaphrodite plants having their corollas dry on the receptacles from which it was not easy to separate them—the scales of the calyx and a part of the stem coming away with them. This is so well known a feature of impregnation in the development of a fruit, that I need not dwell much on the importance of this fact, as showing the fertility of the pistillate, and the sterility of the opposite form.

I engaged friends to furnish me specimens from other places. Dr. James Darrach finds them, as I have above described, in another locality on the Wissahickon. Miss Anderson sends me ten specimens from Edge Hill, Montgomery County, Pa., amongst which two are purely pistillate, the rest varying much as in the Wissahickon specimens. Mr. Isaac Burk finds pistillate plants about at Mount Ephraim, New Jersey, but there are abortive filaments without anthers, and he sends me one specimen of this character. Mr. Charles E. Smith sends me a dozen or so specimens from Haddonfield, hermaphrodite, and so exactly alike that they probably all come from one plant. Mr. E. Diefenbaugh sends ten specimens from another place in New Jersey, all with anthers, but varying from nearly no filaments to filaments three-eighths of an inch long; varying also in the proportionate lengths of scales, tubes and segments; but not near as much as in the Wissahickon specimens. Prof. Cope sends samples from Delaware County, Pa. These are varied like the Wissahickon ones; and Mr. Cope remarks to me that the pistillate forms are so distinctly characterized, by the vasiform recurved corollas and other characters, that he can readily distinguish them as he walks along.

Has this peculiarity of *Epigæa repens* been overlooked by the many botanists who must have critically examined it heretofore? Or has the plant reached a stage of development when germs of new forms spring actively into life?

In a paper on *Lopezia*, published in the last volume of the Proceedings, I showed that the sexual organs of that genus were admirably arranged to prevent the pollen of a flower falling on its own stigma. This behavior of *Epigæa* adds another to the list of plants, now so extensive, known to have an abhorrence of self-fertilization. It may not be out of place to hazard a reason for this course:

There would seem to be two distinct principles in relation to form going along together with the life of a species. The tendency of the one force is to preserve the existing form; the other to modify, and extend it to newer channels. The first we represent by the term *inheritance*, the other we understand
1868.]

as *variation*. Inheritance struggles to have the plant fertilize itself with its own pollen; whilst the efforts of variation are towards an intermixture of races or even neighboring individuals, rather than with members of the one brood or family. May it not be possible that at some time in their past history all species of plants have been hermaphrodite? that Diccism is a later triumph of variation, its final victory in the struggle with inheritance? There are some difficulties in the way of such a theory, as there are with most of these theories; but it seems clear from this case of *Epigæa* that cultivation has not so much to do with changes as it gets credit for, and we may readily believe that, independently of external circumstances, there is a period of youth and a period of old age *in form* as well as *in substance*, and that we may therefore look for a continual creation of new forms by a process of vital development, just as rationally as for the continued succession of new individuals.

The discovery of diccism in *Epigæa* is interesting from the fact that it is probably the first instance known in true *Ericaceæ*. In the *Ericale* suborder of *Francoaceæ*, abortive stamens are characteristic of the family, and in the *Pyrolaceæ* antherless filaments have been recorded.

Monœcism in *LUZULA CAMPESTRIS*.

BY THOMAS MEEHAN.

The recent discovery, that many plants structurally hermaphrodite are practically monœcious or diccious, in consequence of the flower being so arranged as to prevent self-impregnation, is so interesting that every additional fact bearing on the subject has a value.

Luzula campestris, D. C., adds another to the list. The three stigmas are protruded through the apex of the flower bud some days before the sepals open and expose the anthers. In the specimens I marked for observations, six days elapsed before the flower opened, after the pistils had been protruded to be operated on by the pollen of other flowers. This was in a cloudy week, and probably the exact time might vary with the weather. In all cases the stigmas wither away before the flower opens.

After fertilization the stigmas generally twist around one another, and after the anthers have shed their pollen they twist in the same way, withering up in a very short time. An interesting fact in *Luzula* is the slight adhesion at the articulation of the subpedicels with the main flower stalk,—the gentlest force being sufficient to draw them out of their sheaths. It is perhaps owing to this weakness that the pedicels are often drooping when in fruit.

June 2d, 1868.

MR. VAUX, Vice-President, in the Chair.

Twenty-five members present.

The following papers were presented for publication:

"Description of seven new species of *Unio* from North Carolina." By Isaac Lea.

"Descriptions of two new species of *Unionidæ* from Equador." By Isaac Lea.

"New *Unionidæ*, *Melanidæ*, &c., chiefly of the United States." By Isaac Lea.

"On *Agaphelus*, a genus of toothless *Cetacea*." By Edw. D. Cope.

Dr. Leidy called attention to some specimens of *Sombrero Guano* containing about 90 per cent. of phosphate of lime. This substance

[June,

was noticed some years ago by him under the name of Ossite. A similar material has been found near Charleston, S. C., in a post-pliocene formation.

E. D. Cope gave an account of his discovery of the fresh-water origin of certain deposits of sand and clays in west New Jersey, which he found to contain leaves of dicotyledonous trees, ctenoid fish scales, and numerous Unionidæ in a tolerably good state of preservation. The most important part of the deposit consisted of a heavy black clay, which is used for making brick, which rests on a bed of hard laminated clay, with a thin layer of iron-stone between. The clay bed, at one place examined, is 25 feet in thickness, and at from one to three feet from its bottom occurs a bed of fresh water mussels. These are *Unios* and *Anodontas* of six species, all of them, as pointed out to him by Dr. Lea, hitherto undescribed, and having some analogy with those of the Wealden, procured by Dr. Mantell in England. The beds are from the top of the clay down, conformable, and have a dip of about 25° to the south-east. The upper surface of the clay is worn into holes, which are filled by the material of a bed of coarse gravel of little depth, which covers the whole. Above this is a bed of fine sand, varying from six to fifteen feet in thickness to the soil. The point at which the section is visible is in New Jersey, on the banks of the Delaware, about six miles above Camden, N. J.

These deposits belong to Meek and Hayden's Earlier Cretaceous, No. 1, which contains abundant remains of leaves on the Raritan River, but no animal fossils. Their age has been heretofore quite uncertain; they have been stated by Meek and Hayden to be the earlier division of the later Cretaceous of the general geologic series. They extend across the States of Delaware, Maryland and Virginia. In Maryland they are stated by Ducatel to contain the important deposits of carbonate of iron; and Philip Tyson, State Geologist, informs me that these beds lie upon the red and blue clays, forming hills, which have been produced by erosion of the valleys to the beds below. These iron clays contain several species of Cycadaceous plants, whence Tyson infers the age of the clays to be Jurassic, and not Cretaceous.

There are in the Museum of the Smithsonian Institution, Washington, several specimens of fossil *Unios*, from a ferruginous clay which crops out at some elevation on the banks of the Potomac. These species are identical with those which have been found in the New Jersey clays, and the deposit is doubtless the same as that which traverses the State of Maryland.

Indurated grey clays on the Rappahannock River have been examined by my friend Philip R. Uhler, of Baltimore, who has obtained from them leaves and stems of some six species of plants, in beautiful preservation, of the orders Cycadaceæ, Gnetaceæ and Filices. The position and character of this bed renders it exceedingly probable that it is a continuation of those of Maryland and Alexandria.

The whole formation indicates the existence of an extended body of fresh water, having a direction and outline similar to that in which were deposited the red sandstones and shales of the Triassic belt, which extends parallel to its north-west margin throughout the States in which it occurs, separated, except in New Jersey, by a broad band of Gneiss, and Potsdam rocks. The carbonate of iron was no doubt deposited in a bog or bogs along its margin or in its shallows, as the bottom became elevated, as suggested by Tyson,—though not in a salt-water swamp, as supposed by him. The cycads and dicotyledonous trees grew in the swamps and on the shores, while terrestrial reptiles of large size no doubt haunted their shades.

These beds appear to dip conformably beneath the lower Cretaceous marine beds in New Jersey, in which, at a distance of a few miles from their border, occurred the remains of the *Hadrosaurus*; and it is therefore not probable that they were cotemporary with these, as is the case with the Wealden of Kent 1868.]

and the Cretaceous at Maidstone, England. The Hadrosaurus clays, belonging to the upper Cretaceous, as indicated by the presence of many molluscs of the Ripley Group of Mississippi, appear indeed to be separated from the clays in question by a great lapse of time. The age is therefore probably truly Wealden or Neocomian.

These facts indicate the existence of a barrier to the eastward of their present position, which for a long period prevented the access of salt water. This barrier was no doubt an anticlinal of the Appalachian series, outside of that which walled in the Triassic fresh-water area, and, like it, parallel with the general series of anticlinals of the present Allegheny range. That it was, like the latter, at one time submarine, and, gradually rising, finally enclosed the area in question, the waters of which soon became fresh, from the numerous rivers which flowed into it.

On the gradual elevation of this fresh-water valley, with its included beds of clays, etc., the Delaware river cut its way through the latter nearly to the south-eastern rise, and was then deflected along the base of these first elevations of the bounding anticlinal, in a south-west direction. Thus is accounted for the apparently singular phenomenon of the great bend of the Delaware River, near Bordentown. For after penetrating the high ranges of the Blue Mountains, it remains to be turned, apparently, in a level country of sands and clays.

We must suppose the coast line to have been not far from the south-eastern base of this anticlinal, and that a subsequent submergence brought the marine deposits near to the margin of the fresh, and gave the latter the south-east dip visible at the section at the Pea Shore. I have not yet been able to ascertain the relative position of the margins of these beds, nor the nature of those that conceal the supposed anticlinal. A system of borings at a distance of two or three miles from and parallel to the Delaware, would do much towards explaining this point. It is to be hoped that this may be undertaken by the present State Survey, under Prof. Cook.

At the present time, the cities of Alexandria, Washington, and Baltimore stand upon its deposits, and Philadelphia is probably underlain by its margin, as well as the adjoining margin of the Gneiss. Indeed, the location of the prominent cities of the Atlantic States appears to have been determined by the fine sites and water-powers offered by the junction of the high rolling country of the Gneiss formation, and the lower and more level regions of the supposed Neocomian, Cretaceous and Tertiary. Where the Gneiss strikes the ocean, is situated our greatest seaport, New York. Trenton, Philadelphia, Wilmington, Baltimore, Washington, Alexandria, Richmond, Raleigh, Columbia, and Milledgeville, Georgia, are all on this line of junction. The elevated Gneiss hills furnish healthy and beautiful residences, the fall furnishes water-power, and the lower level, water communication, and a light soil most suitable for gardening and the production of provisions for these centres of population.

The succession of strata is rather more complete in New Jersey than has been generally supposed. At the basis of the series occurs the present fresh-water period. Then the marine Hadrosaurus or Ripley clays, and lower Green-sand bed. This deposit my friend John Smock, first assistant of the State Survey of New Jersey, informed me had not found to contain Chelonians. On examination of my own collections and explorations, and those of the Academy, I find this to be true up to the present time. The Chelonians, then, have so far been found in the middle bed of green sand only. Third, the sands, green sand, and limestone pertaining to the middle bed. Lastly, the upper green sand bed, which appeared to approximate closely the London clay, or lower Eocene, in the character of its fauna, in its molluscs, according to Conrad, and especially in the genus of serpents, *Palæophis* of Owen.

[June,

June 9th.

The President, DR. HAYS, in the Chair.

Thirty-seven members present.

The following paper was presented for publication :

"Descriptions of Unionidæ from the Lower Cretaceous formation of New Jersey." By Isaac Lea.

The death of Mr. Matthew Newkirk, member of the Academy, was announced.

June 16th.

The President, DR. HAYS, in the Chair.

Twenty-one members present.

The following paper was presented for publication :

"A sketch of the Natural Order Liliacæ, as represented in the flora of the States of Oregon and California, with special reference to the plants collected in an excursion along our Pacific Coast, A. D., 1866, now in the herbarium of the writer." By Alphonso Wood.

June 23d.

The President, DR. HAYS, in the Chair.

Thirty members present.

The following papers were presented for publication :

"Notice of some vertebrate remains from Harden Co., Texas ;"

"Indication of an Elotherium in Texas ;"

"Notice of some reptile remains from Nevada ;"

"Notice of some vertebrate remains from the West India Islands."

By Joseph Leidy, M.D.

Prof. Cope presented to the Academy some remains of extinct Cetacea from the Miocene bed of Maryland. Of these, some vertebræ, belonging to adult and young individuals, were stated to belong to a species and genus which had not been characterized. He stated that the form was allied to *Priscodelphinus* in its slender and pointed diapophyses of the lumbar and caudal vertebræ, but differed in the concave centrum, with four processes clasping the epiphysis. It was named *IXACANTHUS CÆLOSPONDYLUS*.

The portion of the mandibular ramus of the smallest known finner whale was presented to the Academy and named *BALÆNOPTERA PUSILLA*. The length of the species was stated to have been about eighteen feet, or equal the new born young of the modern fin-backs. Some vertebræ in the collection were also supposed to belong to the same.

He mentioned that he had opportunity of examining a portion of a specimen of the Scrag Whale of Dudley, *Balæna gibbosa* of Erxleben, and ascertained that it represented a genus not previously known. It was a fin-back whale, but without dorsal fin or throat folds, resembling superficially the genus *Balæna*. The baleen short and curved. The genus was called *AGAPHELUS*.

A second species of the genus was to be found in the "gray whale" of the coasts of California. The baleen of this species, compared with that of the *A. gibbosa*, was longer and had narrower basis. The plates moderately and simply concave, while those of the latter are sigmoidal, most curved near the 1868.]

outer margin in cross section. The bristles of the California species were very coarse, varying from one to three series between the enamel plates. The bristles of the *A. gibbosus* much finer, three series together. Length of the latter 8.5 inches, width at base 4.4 inches. In the gray whale or *Agaphelus glaucus* Cope, 22 inches in length, width at base 6 inches. In the former nearly 6 in an inch, in the latter 2½. The baleen of the *A. gibbosus* belonged to an immature specimen of 35 feet in length.

June 30th.

The President, DR. HAYS, in the Chair.

Thirty-nine members present.

The amendment to Art. XXI, Chap. XIII, was adopted, as follows:

"The Department A shall be denominated the Biological and Microscopical Department of the Academy of Natural Sciences of Philadelphia."

Articles VI, VII and VIII, Chap. XIII, were amended to read according to the original tenor, as follows:

"ART. VI.—Each department formed as herein provided, shall elect its own officers and members.

"ART. VII.—Every candidate for admission into a Department shall be proposed in writing by two of its members at one meeting, and be ballotted for at the meeting next succeeding.

"The affirmative vote of three-fourths shall be necessary to elect a candidate, but no election of members or of officers of a Department shall be valid unless there be present at the meeting six legal voters.

"ART. VIII.—Every member elect shall pay to the Treasurer of the Department an initiation fee and a semi-annual contribution, the amount of which shall be determined by the members of the Department, provided that a Department shall not assess its members at a rate exceeding two dollars for initiation and two dollars semi-annual contribution. In other respects the By-Laws, Chap. II, which govern the election of members and correspondents of the Academy, shall apply also to the election of members of any of its Departments."

The following gentlemen were elected members:

Roger Sherman, John E. Carter, Francis P. Steel, Wm. Thompson, M.D., Wharton Barker, Isaac Comly, M.D., Silbert Combs, L. S. Bolles, M.D., J. F. Holt, M.D.

The following were elected correspondents:

Prof. Jas. Orton, Dr. Boynton.

On favorable report of the Committees, the following papers were ordered to be printed:

Descriptions of seven new species of *UNIO* from North Carolina.

BY ISAAC LEA.

UNIO DORSATUS.—Testa lævi, triangulari, ad latere planulata, inæquilaterali, postice subbiangulari, antice rotundata; valvulis subtenuibus, antice crassi-

[June,

usculis; natibus prominentibus; epidermide rufo-fusca, subsquamosa, obsolete radiata, dentibus cardinalibus parvis corrugatisque, lateralibus longis, lamellatis subcurvisque; margarita vel alba vel purpurea vel salmonea et valde iridescente.

Hab.—Catawba River, N. C., C. M. Wheatley.

UNIO DATUS.—Testa lævi, lato-elliptica, valde compressa, inæquilaterali, postice obtuse angulata, antice rotundata; valvulis subcrassis, antice parum crassioribus; natibus prominulis; epidermide rufo-fusca, micanti, obsolete radiata; dentibus cardinalibus parvisculis, sulcatis erectisque; lateralibus prelongis, subcurvis, lamellatis corrugatisque; margarita nubila, salmonea et purpurea et valde iridescente.

Hab.—Paw Creek, Beaver Creek and Long Creek, N. C., C. M. Wheatley.

UNIO BEAVERENSIS.—Testa lævi, oblonga, compressa, ad latere planulata, inæquilaterali, postice obtuse angulata, antice rotunda; valvulis subcrassis, antice parum crassioribus; natibus subprominentibus; epidermide rubiginosa, micanti, obsolete radiata; dentibus cardinalibus longis, crassis, lamellatis subrectisque; margarita vel alba vel purpurea et valde iridescente.

Hab.—Beaver and Long Creeks, N. C., C. M. Wheatley; Carter's Creek, Ga., J. Postell.

UNIO NUBILUS.—Testa lævi, oblonga, subcompressa, inæquilaterali, postice subbiangulari, antice rotundata; valvulis crassis, antice crassioribus; natibus prominulis; epidermide tenebroso-fusca, eradiata; dentibus cardinalibus crassis, sulcatis corrugatisque; lateralibus crassis, longis, corrugatis lamellatisque; margarita nubila, salmonea et purpurea et iridescente.

Hab.—Paw Creek, Mecklenberg Co., N. C., C. M. Wheatley.

UNIO PAWENSIS.—Testa lævi, suboblonga, inflata, valde inæquilaterali, postice subbiangulari, antice rotundata; valvulis subcrassis; natibus subprominentibus, subtumidis; epidermide tenebroso-fusca, squamosa, eradiata; dentibus cardinalibus parvis, corrugatis, subconicis; lateralibus longis, lamellatis subcurvisque; margarita vel alba vel purpurea et iridescente.

Hab.—Paw Creek, Beaver Creek, and Catawba River, N. C., C. M. Wheatley.

UNIO HUMEROSUS.—Testa lævi, elliptico-oblonga, compressa, ad latere planulata, inæquilaterali, postice obtuse biangulari, antice rotunda; valvulis subcrassis, antice crassioribus; natibus prominulis; epidermide rufo-fusca, obsolete radiata; dentibus cardinalibus grandibus, sulcatis, partitis; lateralibus prelongis, lamellatis corrugatisque; margarita salmonis colore tincta et valde iridescente.

Hab.—Charlotte, Mecklenberg Co., N. C., C. M. Wheatley.

UNIO GENUINUS.—Testa lævi, elliptica, subinflata, inæquilaterali, postice subbiangulata, antice rotundata; valvulis subtenuibus, antice crassioribus; natibus subprominentibus; epidermide luteola, valde radiata; dentibus cardinalibus erectis, pyramidatis, in utroque valvulo duplicibus; lateralibus longis, subcurvis lamellatisque; margarita alba et iridescente.

Hab.—Bissel's Pond, Charlotte, N. C., C. M. Wheatley.

Description of two new species of *UNIONIDÆ* from Equador.

BY ISAAC LEA.

UNIO ORTONII.—Testa plicata, lato-elliptica, compressa, valde inæquilaterali, postice angulata, antice rotundata; valvulis crassis, antice crassioribus; natibus prominulis; epidermide rufo-fusca, eradiata; dentibus cardinalibus multipartitis, flexuosis curtisque; lateralibus prelongis, curvatis corrugatisque; margarita albida et valde iridescente.

Hab.—River Napo, Equador, S. Am., Prof. Orton.

1868.]

ANODONTA NAPOENSIS.—Testa lævi, oblongo-elliptica, subcompressa, valde inæquilaterali, antice et postice rotundata; valvulis subcrassis; natibus prominulis; epidermide tenebroso-fusca, encarpiformi, flexuosa, obsolete radiata; margarita pallido-viridi, non iridescente.

Hab.—River Napo, Ecuador, S. Am., Prof. Orton.

Descriptions of UNIONIDÆ from the Lower Cretaceous Formation of New Jersey.

BY ISAAC LEA.

Prof. Cope very kindly placed in my hands the specimens of *Unionidæ* which he collected in a bed of *bluish clay*, now first observed to contain them, about six miles north-east of Camden, N. J. This bed is subordinate to the *Green Sand*, so long known to our geologists as belonging to that portion of the Cretaceous group which furnished so many interesting organic remains within the last forty years, particularly the *Hadrosaurus Foulkii*, Leidy, and the *Laelaps aquilunguis*, found by Prof. Cope. The same member of the *Green Sand Formation* has been very productive also of marine *mollusca*, some of which I described in our Proceedings from the beds near Haddonfield, N. J. But, as observed above, no *fresh water* remains had been found in these cretaceous beds there, and the unexpected development of these *Unionidæ* by Prof. Cope, it is hoped, may lead to other and more extensive results.

These interesting beds in New Jersey have only yet had a very slight development. They will, no doubt, continue to yield their natural treasures to the industrious investigator for many years. The late Prof. Vanuxem, as early as 1818, while examining the Paris basin, was convinced that these New Jersey beds had their equivalent in the *Green Sand* of Europe; and subsequently, in 1828, his notes were published in the Journal of the Academy, where he gave a table of their "relative geological position."

Prof. Cope procured nearly forty specimens of *Unionidæ*, and these are composed of ten species, viz.: eight *Uniones* and two *Anadontæ*. These consist almost altogether of casts, but the forms are well preserved, and in some specimens the inner layers of the nacre are remaining in fragments. These fragments, submitted to the microscope, exhibit the imbricated structure as developed by Prof. Carpenter in the *Unionidæ*, but I could not detect any of that portion of the outer structure of the nacre where the base membrane is deposited in the peculiar cellular structure described and figured in his work. The impress of the muscular cicatrices is visible in many of the specimens. These cicatrices being placed in their usual positions, shewing even the dorsal and pallear scars. While all the massive structure of the cardinal and lateral teeth have been decomposed and carried off, their impress in the clay remains perfect, showing the same forms and striæ which are found in the massive cardinal and lamellar teeth of our western species.

As there are no characters of the shell itself left in any one of the specimens, to designate specific differences, either by form of teeth, color of nacre, or epidermal rays, it remains only to take the outline, transverse diameters, and general curves, to group these specimens. In so doing, I have made these groups conform to the most known species, and named them accordingly. Among these specimens I have noticed none which have nodules or folds, while there is a general resemblance in size and form to those now inhabiting the rivers of the Ohio basin.

As the bed in which these fresh-water shells are found lies below the well-known deposits of "green sand or marl beds," it becomes a very interesting question as to its relations to these superimposed beds. Further investigation can alone give us the data to settle this point. In finding these fresh-water *molluscs* here, we are naturally brought to consider how far they may have relation to the products of those deposits in Europe, where the same genera of

[June,

fresh-water shells have been found abundant; I mean of course the *Wealden* of England, in which the distinguished geologist Dr. Mantell had worked so successfully, and in which he found the *Iguanodon Mantelli*, a gigantic terrestrial reptile, and other animals, together with many fresh-water molluscs, particularly a large number of *Unionids*, analogous in form to these now so happily found by Prof. Cope in this bed below the *Green Sand*.*

I ought to state, in connection with this subject, that Dr. Hayden published with Mr. Meek, some ten years since, observations made by the former regarding the estuary and fresh-water deposits near the mouth of the Judith River, where Dr. Hayden found *Uniones*, *Paludineæ*, &c. These geologists, considering it the lowest, have called this number one. They say in their paper, published in our Proceedings May, 1857, that "the estuary and fresh-water deposits at the mouth of the Judith River are probably in a parallel with the lowest bed of the great Lignite basin, though some portions of them may be somewhat older."

UNIO NASUTOIDES.†—Shell smooth, very wide, compressed, very inequilateral, biangular behind, rounded before; beaks slightly raised, nearly terminal; cardinal teeth short and striate; lateral teeth long, and nearly straight.

Length 1·5 inches, breadth 4·6 inches.

Remarks.—This species is very nearly the same in outline with the well-known *nasutus*, Say, but it is more acute at the posterior margin, in which character it is more nearly allied to *Fisherianus* (nobis).

UNIO RADIATOIDES.—Shell smooth, regularly elliptical, compressed, inequilateral, subangular behind and rounded before; beaks slightly raised, submedial; cardinal teeth large; lateral teeth large, rather long and lamellar.

Length 2·4 inches, breadth 4·3 inches.

Remarks.—Some of the large and compressed varieties of *radiatus*, Lam., are nearly of the same outline with this species, and the beaks are nearly in the same position. It is evidently a species of thickness and weight.

UNIO SUBROTUNDIOIDES.—Shell smooth, subrotund, very much compressed, very inequilateral, rounded behind and before; beaks slightly raised, nearly terminal; cardinal teeth apparently small; lateral teeth long, lamellar and arched.

Length 2·6, breadth 3·4 inches.

Remarks.—Very nearly of the same outline with *subrotundus* nobis, but not so high in the beaks. The lateral teeth seem to be unusually long and curved.

UNIO CARRIOSOIDES.—Shell smooth, broadly elliptical, somewhat inflated, obtusely angular behind, rounded before; beaks somewhat raised, removed from medial; cardinal teeth ———; lateral teeth long and slightly curved.

Length 2·5, breadth 4·8 inches.

Remarks.—This is evidently a very regularly formed species, the curves being gentle and pleasing. It resembles in outline some of the more transverse large males of *carrius*, Say.

UNIO HUMEROSOIDES.—Shell smooth, ovately oblong, very much compressed, rounded behind and before; beaks slightly raised, removed from medial; cardinal teeth large and compressed; lateral teeth rather long and slightly curved.

Length 2·6, breadth 4·2 inches.

* While in London in 1852, my friend Dr. Mantell consulted me in relation to these *Unionids* from the Wealden, of which he had several hundred specimens, with the intention of publishing them. For this purpose I grouped the whole of this fine collection, and assimilated them to those of our existing western species. Owing to severe illness, from which he never recovered, Dr. Mantell did not publish these shells, and his collection was dispersed by a public sale. On my return from the continent to London, fifteen months afterward, I found in the cabinet of the late distinguished geologist, Mr. Sharp, a portion of them, which he had purchased, and which still had the labels which I had written for Dr. Mantell. I am not aware of any of these having been published.

† These descriptions are of course imperfect, being little more than from casts. Specimens of all the species are deposited in the cabinet of the Academy of Natural Sciences. 1868.]

Remarks.—A rather unusual outline, and more like some South American species than our own, except *humerosus* (nobis), which it is closely allied to. The exterior is very much and coarsely striate.

UNIO ROANOKOIDES.—Shell smooth, very wide and slightly curved at basal margin, compressed towards the beaks, rounded before and behind; beaks slightly raised, well advanced towards the anterior margin; cardinal teeth rather large, very much striate; lateral teeth very long, lamellar and slightly curved.

Length 2.6, breadth 4.8 inches.

Remarks.—The form of this species is very unusual, and it is nearest in outline to *Roanokensis* and *macer* (nobis). A portion of the nacre remains on the specimen, but there is no appearance of rays on this or any other of these specimens. The anterior portion is remarkably compressed for a *Unio*; this character somewhat applies to others which accompanied it.

UNIO LIGAMENTINOIDES.—Shell smooth, elliptical, very much compressed, very inequilateral, angular behind and rounded before; beaks slightly raised; cardinal teeth compressed; lateral long, lamellar and curved.

Length 2.3, breadth 3.5 inches.

Remarks.—The outline and general appearance of this shell is nearly that of a compressed male *ligamentinus*, Lam., but rather more arched above. The curves are regular, and no doubt that in a perfect state it must have been attractive as its prototype now existing is.

UNIO ALATOIDES.—Shell alate, smooth, subelliptical, very much compressed, inequilateral, rounded before and behind; beaks raised; cardinal teeth oblique and compressed; lateral teeth long, large, lamellar and very slightly curved.

Length 2.9, breadth 4.2 inches.

Remarks.—A single specimen only is before me, and this by no means perfect. It is very closely allied to *alatus*, Say. The anterior dorsal portion of one valve is gone, and that of the other valve is crushed, but the posterior portion is in a very good state, showing a perfect and deep mould of the large, regular, lamellar lateral tooth, over which the posterior dorsal portion of the disk extends into a well-defined wing, which was connate above, but not extending so high as in *alatus*.

ANODONTA GRANDIOIDES.—Shell smooth, elliptical, very much inflated, ventricose, obtusely angular behind, obliquely rounded before; beaks submedial, flattened at the tips, but very much inflated on the umbos.

Length 3.3, breadth 4.9 inches.

Remarks.—This species is more like *grandis*, Say, than any other of our western *Anodonta*. It is about the same size, and of very nearly the same outline. Both the valves are present, and in their natural relevant positions. The umbos are much inflated, but not so much as the other species (*corpulentoides*) herein described.

ANODONTA CORPULENTOIDES.—Shell smooth, rotundo-elliptical, exceedingly inflated, very ventricose, obtusely angular behind, rounded before; beaks submedial, flattened at the tips, but excessively inflated on the umbos.

Length 3.6, breadth 6.5 inches.

Remarks.—This species is so nearly like *corpulenta*, Cooper, that I have no hesitation to consider it nearest in outline and form to that remarkable species, described by the late Judge William Cooper, and which inhabits the Lake of the Woods, and other north-western waters. There is no mistaking the peculiar great enlargement of the umbos of this species being analogous to *corpulenta*. There are two imperfect specimens before me, but the larger one has the anterior half of the right valve and posterior half of the left valve, which enables me to make a nearly correct description and measurement.

[June,

A sketch of the Natural Order LILIACEÆ, as represented in the Flora of the States of Oregon and California, with special reference to the Plants collected in an Excursion along our Pacific Coasts, A. D. 1866.

BY ALPHONSO WOOD.

(Commencing at San Diego, Jan. 28, I made wide excursions in that vicinity until Feb. 19. Here the hills are covered with four species of the Cacti, with other plants. Thence journeying north, I visited the splendid plains of San Louis Rey, and of Anaheim, &c. Arrived at Los Angeles on the 23d. Here flourish almost all the tropical, together with the temperate fruits, in great abundance. My daily excursions here extended to San Gabriel, to the Granite Mountains north and east, to Cocomungo and San Bernardino east, and to San Pedro west. Next journeyed to San Buenaventura,—a most delightful trip, much of it on the beach. Hence diverged to Ojai Ranch and the Sulphur Mountains. Thence to Santa Barbara, known for its grand Mission church, still in good repair. On the 28th of March I left for San Louis Obispo, where I spent three days on those magnificent plains and lofty buttes. Next on the Salinas Plains, the Gavilan Mountains, and the vicinity of Monterey four days, and April 4th to 7th in the rich Pajaro Valley and adjoining Redwood Hills. April 7th to 17th botanized in the remarkable region of Santa Cruz, and the following week on the splendid plains and hills of Santa Clara and San Jose, south and east of the Bay. April 23d to May 6th, in the vicinity of San Francisco, San Mateo, Oakland, &c.

Our next journey was to the Giant-wood of Calaveras, with side excursions to Sacramento, Lincoln, Folsom, Murphy's and Vallecito, returning on May 31st. The plains were now dressed in their most brilliant robes, in which the golden and purple Mariposas shone conspicuous.

A trip to the Geysers commenced June 1st, when the Geyser Mountains were red with Clarkias. In this journey we visited Petaluma, Sebastopol, Santa Rosa and Healdsburg, which latter place yields a rich harvest to the botanist. Returned June 7th.

Next day commenced our long tour northward, again visiting Sacramento, Marysville, and exploring the Yuba River to near Downieville. Thence Oroville, Chico, are visited; Red Bluff and Shasta, where I explored the head-waters of the Sacramento. Thence over the Trinity Mountains, where Brevoortia had long bloomed unknown, and over Scott's Mountain, reaching Yreka June 17th. From this place enjoyed a grand excursion over the volcanic plains, thirty miles, to Mt. Shasta.

June 21st crossed the State line, on the Siskiyou Mountains, into Oregon, and for three days explored the splendid valley of Rogue River, in the vicinity of Jacksonville. Next three days were spent in pleasant excursions up and down the Umpqua Valley, from the bright little town of Wilbur. At Eugene, 100 miles to the north, entered the vast plains of the Wahlamette River. Reached Albany July 1st, and Salem, the capital of Oregon, July 4th. Here spent three days in botanic trips, in company with Dr. Wythe of the Wahlamette University. Hence thirty miles to Oregon City, a place of infinite water-power, and one hundred miles from Eugene,—the entire length of this great valley. Hence to Portland twenty miles, and to the ocean one hundred miles navigation for the largest steamers.

From the city of Portland, June 9th to 17th, my long excursions radiated, usually in excellent company. By the waters of the Great Columbia I reached the Dalles on the 18th, laboring diligently one week, with Judge Wilson often as guide. Returning, spent one day at the famous Cascades, where the river has torn asunder the mountains, which are supported on columns of basalt. Next I am perambulating the rich woods and meadows of Forest Grove, twenty-five miles west of Portland. A day at Milwaukie, Oswego and Oregon City, where friends and botanists had already collected herbaria for my use. August 7th to 11th at Astoria, and Clatsop Plains, at the mouth of the Columbia. Once more reach, and leave Portland, accompanied by friends brave and true (Dr. Atkinson, J. Deerdorf, &c.), for the Cascade Range and Mt. Hood, in full view sixty miles eastward. On that awful summit we stood Aug. 20th, and estimated its height at 17,000 feet,—water boiling at 180° Fahr.

On the 25th, started from Monticello, Washington Territory, in a canoe rowed by Indians, on a two days' excursion up the Cowlitz River. Everywhere in dark, gloomy forests of the Douglas Fir (*Abies Douglasii*),—would supply the world with lumber for a thousand years. Finally, on the 31st, leave Portland by steamer Montana for the Pacific, and for San Francisco, 600 miles distant.

Our final excursion was to the Yosemite,—last, not least. A day or two at Benicia and around Mt. Diablo (whose flowers had already been gathered for me by Rev. J. P. Moore), once more at Stockton, and across the vast plain to Bear Valley, Mt. Bullion, and Mariposa, and I surveyed alone the Giant-wood of Mariposa. Four days I went up and down in Yosemite, plucking flowers from the bases of cloud-capped rocks, and on the 22d of September am again in San Francisco, whence, on the morning of the 29th, with many a trophy, I embarked for home.)

Tribe I.—*TULIPEÆ*.

Erythronium grandiflorum, Pursh. Scape tall (1—2 f.), 1—3-flowered; perianth segments yellow, acuminate, reflexed from near the base; stigmas 3, distinct, revolute; leaves spotless.—Woods, from the Sacramento to the Co-1868.]

lumbia River, and northward. Bulb oblong-ovoid. Flowers (when more than one) racemed, as if by the splitting of the scape.

β. multiflorum (Torr.) Flowers 5—8 in the raceme.—Sierras.

γ. multiscapidea (Kellogg). Scapes several, all radical, each 1-flowered.—Sacramento Valley (Dr. Stillman. V. s. in herb. Torrey). A remarkable plant; but the scape is often one only, and then undistinguishable from var. *α*.

E. GIGANTEUM Lindl. Scapes 5 or 6-flowered; segments acuminate; stigmas united and club-shaped, somewhat 3-lobed.—Oregon to Idaho (Mr. E. Walker), and northward. My specimens are all 1-flowered, and too small to justify Lindley's name. Flowers straw-yellow.

LILIUM CANADENSE, *β. puberulum* (Torr.?) Tall, strict (3—4 f.); stem and peduncles minutely puberulent; leaves some opposite, some verticillate, often some scattered; flowers few (often but one); segments orange-yellow, with brown dots, oblong, reflexed from below the middle; anthers oblong; stigma entire, 3-lobed.—Yuba Co. to the Columbia. Flowers large, showy, 1—7. June, July.

γ. minus.—Glaberrimum; foliis plerumque sparsis; flore sæpius unica *β* dimidio minore; antheris ovalibus, basi affixis.—Meadows near Mt. Shasta, and in Oregon. June. (Var. *parviflora* Hook. is undescribed.)

δ. Walkeri. Floribus multis (12—15) minimisque (policaribus); racemo elongato; foliis verticillatis—Idaho (Mr. Elkanor Walker).

L. WASHINGTONIANUM (n. sp.) Glaberrimum; foliis plerumque verticillatis, oblanceolatis vel obovatis, breviter acuminatis; floribus permagnis, infundibuliformibus, basi attenuatis, umbellatis vel sæpe solitariis, subnutantibus; segmentis spatulatis, apice cuspidatis, basi longe angustatis, supra recurvatis, 3-policaribus; intus fusco-maculatis, odoratissimis; anth. oblongis; stig. integro.—In woods here and there, from Yosemite to the Columbia. 3—5 f. Flowers purple, varying to white.

This splendid lily seems to have been overlooked by the botanists, or confounded with the preceding. It is well known to the miners, who recognise its superior qualities, and call it the "Washington Lily."

FRITILLARIA, Tournef.

* Flowers tessellated, purple and yellow. Caps. 6-winged.

F. MUTICA Lindl. Stems many (3—9)-flowered, naked below; leaves verticillate, linear-lanceolate, obtusely pointed; flowers racemed, nodding, bell-form, as long as the pedicles (1'); segments oblong, acutish, tessellated with dull purple and greenish-yellow; style trifid; capsule 6-winged.—California; common in the interior. 2—3 f. Lvs. 2—3'. The one radical leaf is ample, elliptical. Bulb of white, thick scales. April, May.

β. foliosa.—Procera; foliis majoribus (5—6'); floribus parvulis, segm. linearibus, 9''.—In deep shades, Redwood hills. 3—5 f.

F. LANCEOLATA Ph. Stem strict, 1—2-flowered; leaves lanceolate and linear-lanceolate, verticillate or opposite; flowers nodding, obconic, obtuse at base, longer than their pedicels; segments oblanceolate, rather obtuse, tessellated with purple and yellow; capsule broadly 6-winged.—Monterey to Portland, north and east. 1—2 f. Lvs. 2—3'. Stem naked below, as in *F. mutica*. The capsule is broader than long. It is more than probable that *F. mutica* runs into this.

F. PARVIFLORA Torr. (P. R. R. Rep. IV.) Leaves narrowly lance-linear, whorled or scattered; flowers small, few or many, in a long raceme, on short pedicels, nodding; perianth narrow at base; style trifid to near the middle; capsule 6-winged.—Santa Cruz, Gavilan Mts. Murphy's (Calaveras Co.) Radical leaf broad. Stem lvs. about 2' by 2''. Flowers 1—20, greenish and purple.

[June,

** Flowers brownish-purple, not tessellated. Fr. wingless.

F. KAMTSCHATCENSIS Gawl. Bulbs granulated; leaves lanceolate, irregularly verticillate; flowers 1—3, pendulous, brown-purple, spotless, bell-form, much longer than their pedicels; segments lance-elliptical, acute, veins inside more or less lamellated; nectaries oblong; capsule obtusely 6-angled.—Coast, San Diego to Sitka (and Kamtschatka). The bulb consists of thick farinaceous scales, loosely conjoined. Stem 8—12'. February—April. (*F. biflora* Lindl.)

F. RECURVA Benth. Stem tall, naked at base; leaves linear or oblong-linear, some whorled near the middle of the stem; flowers several, subcylindrical, suberect; segments oblong, reflexed at the end, longer than their pedicels; stigmas subconnate; ovary oblong, fr. wingless.—California (Hooker), Umpqua Valley, Oregon (Mrs. Royal). 2 f. Flowers 1½ inches long, light purple.

*** Flowers yellow. Capsule wingless.

F. LILIACBA Lindl. Stem leafy at base; leaves oblong-lanceolate and linear, the lower whorled or opposite; flowers 1—5, racemed, nodding, bell-form, with a narrow base, yellow; pedicels erect, longer than the bracts; capsule oblong, blunt at both ends; style 3-cleft.—San Francisco (Dr. Stillman), Benicia (Rev. J. P. Moore), to Nevada. 8—14'. Nectary a groove. Very pretty. March.

F. PUDICA Spreng. Low; leaves lance-linear and linear, opposite or scattered; flower solitary, nodding, bell-form, yellow; peduncle as long as the bract, recurved at top; segments oblong-obovate, obtuse; style and stigma undivided; ovary wingless.—Dalles of the Columbia (Mrs. Wilson), and east. 6—9'. Leaves few, 3'. Nectaries nearly obsolete, hence first named by Pursh a *Lilium* (*L. pudicum*).

YUCCA ALOIFOLIA L.?—Hills, near the Hot Springs, San Bernardino (March 10th), only the leaves and the dead scapes of the preceding year. Leaves densely capitate near the ground, 12—15' by 1', very rigid, sharply serrulate, glaucous, ending in a strong spine. Scapes very stout, 10—15 f. high.

Y. GRAMINIFOLIA (n. sp.?)—Mountains twelve miles east of Los Angeles (March 3d). Saw only leaves, and dead scapes with the fruit. Leaves very numerous, in a dense radical crown, linear, 2 f. by 3—4'', glaucous, not very rigid, rough-serrulate, round-carinate, involute above, and ending in a sharp spine. Scape 10—15 f. high, paniculately branched, bearing hundreds of "white, bell-form, pendulous" (Mr. Hoover) flowers. Capsule 1' thick, 1½' long, 6-lobed, 6-celled, packed full of disc-form, thin, black seeds. The leaves are not at all filamentous.

Y. FILAMENTOSA L.?—Mountains east of Los Angeles, with the last. Only the leaves seen (March 3d), which are densely clustered, yellowish-green, with brown spots and transverse lines at intervals, with no midvein, thick, lance-linear, rolled above and sharp-pointed, margin splitting into strong, recurved filaments.

CALOCHORTUS, Pursh. (Καλός, beautiful, χίτρος, grass.)

(*Cyclobothra* and *Calochortus* of authors.)

Perianth 6-parted, regular, deciduous; segments distinct, contorted in aestivation; sepals oblong or lance-linear, spreading, much smaller than the petals; petals connivent or spreading, broadly obovate, cuneate-unguiculate, bearded within, with a glabrous spot above the base; stamens 6, perigynous; fil. subulate; anthers linear-oblong, deeply perforated at base where the filament is inserted; ovary free, 3-angled; style very short or none; stigmas recurved, persistent on the 3-celled, 3-valved, chartaceous capsule; seeds angular, one row in each cell.—Bulbous erect herbs of the North American Pacific States. Leaves narrow, acuminate. Flowers few, terminal, solitary, nodding or erect, showy.

1868.]

The acknowledged error of Lindley, Kunth, &c., of referring the *original species* of Pursh (*C. elegans*, A.D. 1816) to a genus invented ten years later (*Cyclobothra*, Sweet, 1836), is avoided by including both genera in one, under Pursh's name. Moreover, Sweet's genus cannot possibly be distinguished by "fovea nectarifera alba impressa" (the only distinction relied upon), for in *C. elegans* and its congeners "the pit" fades away by degrees, becoming imperceptible. If, however, the two genera be insisted on, Sweet's name must give place to the prior one of Pursh, and a new name (none more appropriate than *Mariposa*) conferred in place of the *Calochortus* of Lindley, &c. No one acquainted with these beautiful flowers will regret the disuse of so distasteful a name as *Cyclobothra*.

§ *Calochortidea*. Petals impressed inside with a nectariferous pit, which is gibbous outside, beard scattered, soft, margin ciliate-fringed.

* Perianth ventricuous, pendulous.

C. PULCHELLUS. Erect, branched above; flowers globous, yellow; the upper in pairs and threes, lower often solitary, all with long bracts; sepals lance-ovate, acuminate; petals concave, connivent, fringed, twice broader than the sepals, the pits large and deep; anthers mucronate; ovary ovoid.—Mt. Diablo (Rev. J. P. Moore), and the interior of California generally, less common than the next. 1 f. Its pendulous golden globes make a fine appearance. May. (*Cyclobothra pulchella* Benth., in Hort. Trans., n. ser., i, p. 413.)

C. ALBUS Dougl. Erect or inclined, branching; flowers oblong, inflated, white, the upper in pairs, with lanceolate acuminate bracts; sepals oval, much shorter than the concave, scarcely fringed petals; anthers obtuse; ovary obovoid.—California, common in all the foot hills. 1—2 f. Leaves and bracts lance-linear and long pointed. Flowers 1' or more long, of a delicate pearly whiteness. May, June. (*Cyclobothra alba* Benth., l. c., *C. alba* and *paniculata* Lindl.)

** Perianth expanding, nodding (not pendulous).

C. ELEGANS Pursh. Stem slender, with one radical, linear leaf; flowers in pairs or threes, open, nodding or suberect, white or purplish; sepals oblong, cuspidate, greenish-purple, the petals much larger, roundish-obovate, soft-bearded within except its purplish pit, ciliate-fringed, and a short cusp at apex; anthers acuminate, white; stigmas recurved; capsule 3-winged, finally oval and reflexed on the elongated pedicels.—In cool mountain shades, Mt. Shasta to the Columbia. 10—16'. Petals near 1' long, the pit strongly impressed. June. (*C. Tolmei* Hook., *Cyclobothra elegans* Lindl., Bot. Reg. t. 1663.)

β. *nanus*. Folio angustè lineari v. filiformi, florem unicum longe excedente; ped. filiformi bracteis subulatis duabus instructo; perianthii capillis fuscis.—High hills, Yreka. Also on Mt. Hood. 5—8'. June—August.

§§ *Mariposa*. Perianth erect, open. Sepals convolute-acuminate. Petals plane, erect-spreading, often spotted, but with no nectariferous pit. Seeds oval, compressed. (Vide *C. venustus*, below.)

* One radical leaf exceeding the slender stem. Petals straight, spotless? Pods oval, obtuse, nodding

C. UMBELLATUS (n. sp.) Folio radicali unico, lineari, caulem et bracteas foliosas longe excedente; floribus 5—9, fere umbellatis, erectis; pediculis subradicalibus, longissimis, ebracteatis, fructiferis recurvatis; petalis flabelliformibus, apicè rotundatis, erosis, glaberrimis, basi squamâ ciliatâ instructis, albis, concoloribus; antheris oblongis, obtusis; capsula 3-alata.—In collibus altis prope Oakland, California (legimus Sanborn et nos). Caulis 6—8 poll. Folium pedale. Petala 10 lin. Maia. (*Cyclobothra elegans*, var. Torr.? R. R. Rep. iv.) Distinguished from *C. elegans* by its many flowers, beardless petals, entire absence of nectary, &c.

.. *C. UNIFLORUS* Hook. One radical lance-linear leaf larger than the several cauline ones; flower single, lilac, on a long, nearly radical peduncle; sepals linear, acuminate; petals triangular-fan-shaped, bearded just at base, with a

[June

small purple spot; anthers linear-oblong, obtuse, blue; style short, distinct. —High plains, Santa Cruz, &c. Scape 6'. Flower 1' long. April. Clearly distinct.

C. nitidus Dougl. Radical leaf lance-linear, much larger than the few cauline, all long-pointed; flowers 3—4, orange-yellow, pedicels elongated; sepals elliptic, acute; petals same length, roundish, bearded all over inside with clavate hairs; anthers short, acuminate; capsule oval, wingless, drooping.—Yuba and Tuolumne Counties. 6—8'. Leaf 1 f. Flowers brilliant, 15" broad. May.

β. cornutus. Sepalis longè acuminatis, corollam excedentibus. Flore unica; fol. angustè lineari.—Dutch Flat. 4—6'. Fl. 1' lato.

** Stem leafy, erect, branched, rigid. Perianth large, broad-campanulate, the petals recurved-spreading above the middle, spotted (except *C. Weedii*).

C. venustus Benth. Branches few, 1-flowered; leaves few, narrowly linear; sepals lanceolate, acuminate, greenish outside, a purple eye bordered with yellow inside; petals many times larger, flabelliform, straw-white, variegated, a tuft of hairs below, a purple crescent bordered with yellow near the middle; stamens one-third as long as petals, anthers longer than filament; pod lance-oblong.—Plains and foot hills, California. 1½—2 f. Flowers 2½ inches broad. This splendid flower (with the next two) has long been known to the native Californians by the name of *Mariposa* (Spanish for butterfly).

C. splendens Benth. ? Stem stout, 3—5-flowered; leaves narrowly linear; sepals lanceolate, acuminate, revolute, green, longer than the petals, a small brown spot in the middle; petals broad-obovate, rounded at apex, lilac, sparsely bearded below, a brown-yellow eye in the middle; anthers large, longer than filament (6"), blue (Bentham).—Santa Clara, &c., not rare. 1—2 f. Flowers as large as in No. 7. Perhaps it runs into that species. May.

C. macrocarpus Dougl. Bulb oblong; stem 5-leaved, 2-flowered glaucous; leaves convolute, sheathing at base; pedicels enlarged upwards; sepals lance-linear, longer than the petals, lilac, with a green line outside; petals obovate, short acuminate, tapering to base, lilac or bluish-purple, greenish at base inside, and with a tuft of beard; anthers acuminate, as long as filament; capsule lance-oblong, very long (3—4').—Dalles of the Columbia, &c., common. August.

C. luteus Dougl. Stem about 3-flowered; leaves convolute-acuminate, shorter than the slender peduncles; sepals oblong, pointed and recurved at apex, scarcely shorter than the petals, yellow; petals yellow, broad-cuneate, rounded at apex, bearded across the base, a roundish red spot near the middle; anthers as long as filament; capsule elliptical.—Plains of Sacramento and San Joachin. 1—2 f. Flowers smaller than in the foregoing, very brilliant. May.

C. WEEDII (n. sp.) Caule subtrifloro; foliis convolutis-filiformibus, pedunculo divaricato multo brevioribus; floribus aurantiacis-luteis, concoloribus; sep. oblongis, acuminatis, petala excedentibus, basi barbatis; pet. cuneato-obovatis, intus omnino barbatis, ciliatis, basi barbis fasciculatis; stam. fere longitudine petalorum, anth. filamentis brevioribus; ovario lineari.—San Diego (ligit *Weed*). Caulis gracilis, rigidus, 1—2 ped. Flores magnitudine *C. lutei*; pet. 15 lin. Stam. et pistilla, 1 pol. April. Very distinct.

C. NUTTALLII Torr. "Stem 2-flowered; leaves very narrowly linear; petals obovate cuneate, rounded at summit, white except the yellow base, with an oblong dense tuft of hairs on the claw, a purple spot just above, and a few scattered hairs. (*C. luteus* Nutt.) Noble's Pass, Sierra Nevada, July 3." (P. R. R. Rep. ii, 124.) *V. s. in herb Torr.**

* The frequent references like the above, in these pages, indicate the extent of my obligations to that eminent botanist, Dr. John Torrey, of Columbia Coll., New York.

Tribe II.—*ASPHODELEÆ*.

CAMASSIA ESCULENTA Lindl.—Fine specimens from Marin Co. (Dr. Stillman) to Portland (Mr. Walker, Mrs. Shepley). Bulb white, furnishing to the Indians a rich diet. Leaves broadly linear, nearly the length of the scape (12—18'); raceme 6—10-flowered. Flowers 1' long, blue, alternate. Sepals lance-oblong, 5—7-veined. Cells of the capsule about 12-seeded.

ALLIUM, Linn.

‡ Bracts of the spathe 2, rarely 1 or 3.

* Sepals acuminate, longer than the stamens.

A. FALCIPOLIUM Hook. Bulb globular, white; leaves 2 or 3, linear, recurved, shorter than the scape; spathe colored, of 1 or 2 bracts, shorter than the pedicels; flowers 10—30, rose-purple, two or three times shorter than their stalks; sepals lance-ovate, carinate-acuminate, more or less glandular-serrulate, recurved, more than twice longer than the unequal stamens.—San Diego to Salem (Oregon). 10—20'. Pedicels 1'—18''. March—May. Hooker's plant had "lanceolate" leaves. None wider than lance-linear appear among my specimens.

A. DOUGLASSII Hook. Bulb ovoid, white; leaves linear, erect, mostly two, shorter than the scape; spathe 2 bracted, about as long as the pedicels; flowers about 20, rose-purple, two or three times shorter than their stalks; sepals ovate, gibbous at base, rather acuminate, straight, a third longer than the subequal stamens.—Throughout Oregon, California and Nevada. 10—20'. Pedicels 1'. San Diego specimens have sepals broadly ovate, merely acute. Nearly allied to *A. falcifolium*, but readily distinguished by the sepals (sepals and petals).

A. ACUMINATUM Hook.? Bulb ovoid, often purplish; leaves 2—3, narrowly linear, shorter than scape; umbel densely ∞ -flowered, globular, 1' or more in diameter; spathe 2—3-bracted; pedicels not longer than the purple flowers (3—5''); sepals ovate or oval, acuminate, gibbous at base, near twice longer than the stamens; capsule ripening 1—3 black seeds.—Hills, Santa Clara Co. to the Wahlamette. Scape 1 f. or more. Umbel small and compact, 20—40-flowered, very pretty. April, May.

β. gracile. Scapo gracillimo; umbella 20-flora, $\frac{3}{4}$ pol. diam.; segmentis (siccis, post anthesin) infectis, albis; semine unico.—On Feather River, Oroville.

** Sepals acute, equalling the stamens.

A. TRIBRACTEATUM Torr. Bulb ovate; scape low (3—4'); leaves 2, linear, much longer than scape; umbel 15—20-flowered; spathe of 3 ovate bracts; sepals lanceolate, acute; about equalling the stamens; capsule broadly obovate, 3-lobed, cells 2-seeded.—Hill sides, Duffield's, Sierra Nevada (P. E. R. Rep. iv, 92). *V. s. in herb. Torr.*

A. AMPECTENS Torr. Bulb large; scape low, flexuous; leaves 2, longer than scape, filiform; umbel 3—6-flowered; spathe of two round concave bracts embracing the flowers; sepals oblong, obtuse; capsule 3-lobed, depressed, 6-seeded.—Hill sides, Sonoma, Cal. (Torrey, l. c., *V. s. in herb. Torr.*

*** Sepals acute, stamens exserted.

A. CERNUUM Roth.? Bulb ovoid-oblong, tapering upwards; leaves 5—8, narrow-linear, erect, shorter than the scape; umbel fastigiate, nodding, finally erect, with a short 2-leaved spathe, and about 20 small roseate flowers; sepals oblong-ovate, acute, shorter than the stamens and slender style; ovary 3-lobed, crowned with a 6-lobed crest!—Dalles of the Columbia and east. $1\frac{1}{2}$ feet. Bulb $1\frac{1}{2}$ in. long, eatable. Flowers 2'' long. Umbel 1' broad. August.

[June,

This plant combines the exerted stamens of *A. cernuum* with the 6-lobed crest of *A. stellatum* Nutt.

♂♂ Bracts of the spathe 4—6.

A. SANBORNII (n. sp.) Bulbo ovato, albo; foliis ante anthesin evanescentibus (ignotis); scapo gracilente, procero (2—3 ped.), basi longè vaginatis; umb. globosa, confertim 40—100 flora; spatha e bracteis 4 lanceolatis acuminatis; ped. filiformibus, floribus purpureis longioribus; segm. erectis, oblongis, basi gibbosis; interioribus longioribus; stam. et stylo gracillimo exertis; fil. capillaribus, basi dilatatis; stigm. trifida; caps. trilobata, tri-sperma, glandibus 3 coronata; spermatibus angulatis, albo-luteis (immaturis).—In collibus umbrosis, Yuba Co. prope Foster's Bar (S. S. Sanborn, Esq.) Aug. Flores 3 lin. longi.

A. MARITIMUM Torr. Bulb globular, corm-like; leaves 3—6, linear, longer (often shorter) than scape; umbel about 10-flowered, fastigiate; spathe of 3—6 narrow bracts, sepals distinct almost to base, oval, with a wide midvein and callous tip, some longer than the stamens; fil. dilated at base; capsule globular, size of a peppercorn, 30-ovuled, perfecting about nine black seeds.—Hills near the sea and bay, Santa Cruz to Benicia and Marin Co. 6—12'. Flowers small, white. April.

A. CROCUM Torr. Leaves several, linear, as long as the slender scape (1 f.); umbel 9—12-flowered, pedicels spreading, 8—10''; spathe of 4—5 lanceolate, acuminate bracts; sepals oblong, acutish, orange-yellow, 4—5''; stamens shorter, fil. 2-toothed at base; capsule obovate.—Mountains east of San Diego (Mex. Bound. Rep. ii, 218). *V. s. in herb. Torrey.*

HESPEROSCORDERIUM, Lindl. (*Ἑσπερος*, evening, *σκόρδος*, garlick.)

Perianth acute at base, articulated to the pedicel; segments 6, distinct, spreading above; stamens six, short, equal, fil. dilated, coherent and perigynous at base; ovary stipitate, many-ovuled; style slender; capsule ovoid, 3-celled, 3-valved; seeds 6, black.—Corm coated, scape umbelliferous. Involucre of 4 or more bracts. Flowers erect, white.

H. LACTEUM Lindl. Corm globular, fibrous-coated, brown; leaves 2, linear, shorter than the tall scape; flowers 10—25, shorter than their pedicels; segments cream-white, 1-veined, oblong, obtuse, 6—7'' long; fil. at base broad and connate, forming a corona half the length of the perianth; stipe nearly the length of the capsule.—San Mateo Co. (Mr. Easton), to the Sacramento and Waihamette. 2 f. (*H. hyacinthinum* Lindl. is the same plant.)

TRITELEIA, Dougl. (*Τρίς*, thrice, *τέλεος*, complete.)

- Perianth 6-parted, funnel-form, persistent, segments spreading, 1-veined; stamens 6, the 3 inner higher and longer; fil. dilated, coherent to the tube, anthers linear-oblong, fixed by the middle; stigmas 3-lobed, style distinct; capsule short-stipitate (in our species), cells 3, about 10-seeded.—Bulbous. Scape umbellate or 1-flowered. Spathe of 2 bracts.

T. GRANDIFLORA Lindl., Hook. Leaves linear, glaucous, shorter than the tall (2 f.) scape; spathe equalling the pedicels, which are scarcely as long as the perianth; stipe shorter than the ovary or the style; stigmas 3-lobed; umbel few-flowered.—Plains of the Columbia and Waihamette. The specimen in Dr. Torrey's herbarium is from the Dalles. I did not meet with it. (*V. s.*) Flowers white?

SUBERTIA, Kunth. (In honor of Dr. Subert, a German botanist.)

Perianth funnel-form, attenuate at base, half-6-cleft; segments erect, 3-veined in the middle; stamens 6, included, fil. inserted at top of tube; anthers. 1868.]

versatile, ovate lanceolate, obtuse, the 3 inner higher than the 3 outer; ovary oval, longer than its style, 3 to 5 times shorter than its stipe; capsule ovoid, ripening few black seeds from many (15—45) ovules.—Bulbous. Leaves lance-linear. Scape umbellate. Spathe of 3—6 narrow bracts.

S. LAXA Kunth. Bulb globular, fibrous-coated; leaves as long as the scape (12—18'), broadly linear (5—8'); pedicels 10—20, suberect, 2—3'; flowers violet-purple, segments with a triple midvein; stipe 5 or 6 times as long as the ovary (near 1').—California, middle and northern counties. Bulb as large as a musket ball. Flowers 16' long. April, May. Very handsome.

S. CROCEA (n. sp.) Foliis 1—2 (v. pluribus?), linearibus, conduplicato-falcatis, erectis, scapo gracilente brevioribus, obtusis; spatha e bracteis 4 subulatis acuminatis, pediculis breviora; floribus 5 v. 6, basi acutis, supra sensim dilatatis (9 lin. longis), segm. æque obtusis, medio vena forti instructis; anth. oblongis, interioribus duplo altioribus; ovario quam stipes crassus triplo breviori; loculis 5-spermis.—Yreka, California. Caulis pedalis. Flores crocei. June.

CALLIPRORA, Lindl. (Καλλος, beauty, πρόμα, front.)

Perianth of 6 segments united at base into a turbinate tube, spreading above; oblong, 1-veined; stamens 6, perigynous, 3 of them longer, fil. dilated, all tricuspidate, the middle cusp shortest, bearing the anthers; ovary short-stiped; style and stigma undivided; capsule 3-celled, ∞-seeded, seeds black.—Bulbous. Leaves linear-ensiform. Scape umbellate. Spathe of 3 or 4 bracts. Flowers 5—20, yellow. (*Calliproa* Kunth.)

C. LUTEA Lindl.—Hills, Santa Cruz, to Healdsburg and the Sierra Nevada. A handsome plant, 1 f. Bulb globular. Leaves 1—3, as long as the scape, channeled. Segments 6—10' long, the vein greenish outside. Pedicels 1—2'. Specimens from the Coast Range have a much smaller flower than those from the interior. April, May. Differs from *Subertia* chiefly in its stamens.

BRODIAEA, Smith. (Named for James Brodie, Esq., of Scotland.)

Perianth funnel-bellform, outer segments narrower; stamens 6, inserted into the throat of tube, exerted, outer anthers sterile, petaloid, the inner fertile, erect, fixed by the cleft base (shorter than the segments); ovary fusiform, narrowed to the sessile base; cells 3, 5—7-ovuled, style equalling the stamens, stigmas 3-fid; capsule substipitate.—Bulbous. Leaves 5, linear, exceeding the scape. Umbel few-flowered. Spathe 2-bracted. Flowers large, violet blue.

B. GRANDIFLORA Sm., s. *macrantha*, Torr. Bulb depressed-globous, fibrous-coated; pedicels stout, divaricate, then erect; flowers 4—8, rarely but 1, the inner segments nearly twice broader than the outer, all spreading above. Sterile stamens usually longer than the fertile, emarginate, yellowish.—Plains and hills, California. 8—18'. Flowers large, varying from 1' to 2' in length, on unequal stalks.

B. TORREYI (n. sp.) Bulbo magno, depresso, tunica reticulata instructo; foliis multo elongatis; umb. 5—10-flora, subradicali v. scapo brevissimo, pediculis valde inequalibus; perianthii segm. suberectis, omnibus obtusis; anth. oblongis, castratis elongatis, bifidis.—Swampy places about Oakland, Napa, to Marysville, &c. Leaves 6—10'. Pedicels 3—6'. Flowers $\frac{3}{4}$ inch long. I often saw the live plant, always with the same habits and characters. (*B. grandiflora*, *B. macropoda* Torrey, Bot. Whipp. Rep. 93.)

B. PARVIFLORA Torr. Scape roughish; umbel 15—20-flowered; pedicels shorter than the flower; sterile stamens ovate lanceolate, rather acute, entire; cells of the ovary 6—8-ovuled.—Sierra Nevada. (Torrey, in P. R. R. Rep., ii, 125.) *V. s.*

[June,

DICHELOSTEMMA, Kunth. (*Δίχλωος*, bifid, *στῆμμα*, crown.)

Perianth 6-parted, limb erect or spreading; fil. 6, dilated, perigynous, the 3 outer exserted, petaloid, 2-parted either with or without an anther between the lobes, the 3 inner wholly adnate, antheriferous, rarely appendaged; anthers bifid at each end; ovary 3-celled, cells 3—5-ovuled; seeds few or many, black.—Bulb or corm globous. Leaves linear, flat. Scape tall, wiry, bearing a dense umbel of flowers. Spathe of 3 or 4 broad bracts.

‡ Only the three outer filaments appendaged. Flowers violet-blue.

D. CONGESTA Kunth. Leaves 1—2, narrowly linear; scape flexuous, erect (2 f.); flowers subsessile, in a globular umbel, tube tumid at base, contracted above the globular ovary; anthers 3; pedicels roundish; seeds angular, 5 in each cell.—Oregon and N. California, common. Flowers 9" long, about a dozen in each umbel. March—May. (*Brodiza congesta*, Smith.)

D. CAPITATA Benth.? Leaves broad-linear, glaucous; scape straight, erect (2 f.) flowers subsessile, few (5—9), compact, broad at base, not contracted above; anthers 6; pod ovoid, with 9 elliptical seeds.—San Diego to Yreka; often seen with the other, readily distinguished at sight. The seeds are thrice larger than in the preceding. The bulbs of both are largely eaten by the Digger Indians. February—April.

‡ *Stropholirion*, Torr. Filaments all appendaged; the lobes of the antheriferous much shorter than those of the sterile.

D. CALIFORNICA. Leaves long, linear; scape terete, twining on anything in reach, 5—10 f. Umbels capitate, with 4 or 5 bracts; flowers tubular-bell-form, rose-purple, somewhat constricted above the ovary, articulated to the pedicels; cells 4-ovuled, 1-seeded; seed oblong, black. Common in the foot hills, Marin, Yuba and Placer counties. May. (*Stropholirion californicum*, Torrey, in P. R. R. Rep. iv. 149.)

BREVOORTIA, Wood. Proc. Phila. Ac. N. Sci., June, 1867.

(Dedicated to J. Carson Brevoort, Esq., Reg. N. Y. Univ.)

Perianth tubular-pyriform (scarlet red), persistent, limb 6-toothed, reflexed, crown erect, of 3 broad truncate scales; stamens 3, fil. adnate, anthers free, exserted, opposite the inner segments (teeth), alternate with the scales of the crown, deeply bifid at base; ovary ovoid, 3-celled; cells 4-ovuled, style slender; capsule?—Bulbous? Leaves long, linear. Scape tall, erect, umbellate. Spathe of 4 bracts. Flowers 8—12, pedicellate, nodding.

B. IDA-MAIA Wood. High hills of the Trinity Mountain Range, Shasta Co., Cal. Glabrous, 2—4 f., leaves nearly as long, channeled. Flowers 1' long, pedicels 1—2'. Singularly beautiful, the tube scarlet, lobes chrome-green, crown yellow, and umbel subtended with 4 purple bracts. May, June.

CHLOROGALUM, Kunth. (*Χλωρίς*, green, *γάλα*, milk.)

Perianth of recurved-spreading segments; stamens 6, equal, scarcely perigynous, as long as the segments; anthers 2-celled, fixed by the back; ovary free, sessile, cells 3, 2—3-ovuled; style filiform, stigma tricuspidate.—Bulb tunicated. Leaves radical, linear, carinate. Scape branching, with paniced racemes. *Soap Plant*.

C. POMERIDIANUM Kunth.—California, throughout the open country. The bulb is invested with a dense mass of black, hair-like fibres. Leaves broad-linear, recurved, the margins undulate. Scape 2—3 f. high, bracted, with a few spreading branches. Flowers erect, broad, white, in long loose racemes, open only at mid-day in May. The bulb is alkaline and mucilaginous, answering well for soap.

1868.]

ODONTOSTOMUM, Torr. ('*Odont*, tooth, '*stoma*, mouth.)

Perianth salver-form, tube cylindric, limb of 6 equal spreading segments as long as tube; stamens 6, perigynous to top of tube, alternating with as many sterile filaments; style filiform; ovary globose, nearly free, 3-celled, 6-ovuled, capsule 6-seeded.—Bulbous, with broad linear leaves sheathing the divaricately branched stem. Flowers small, racemed, white.

O. HARTWEGII Torr.—Foot hills, Yuba, Placer and Sacramento counties. 1—2 f. Radical leaves flat, 3—6'' wide, 5—7-veined. Segments 5-veined, reflexed after flowering. Stamens and sterile fil. barely exerted. May.

Tribe III.—SMILACINEÆ.

SMILACINA RACEMOSA Desf.—Common in the Redwood hills, Pejaro to the Russian R., Cal. In no wise different from the eastern plant.

S. STELLATA Desf.—Santa Cruz, with the last, north to the Columbia River from Astoria to the Dalles. 1 f. Raceme loose, few-flowered. Berries red.

CLINTONIA ANDREWSSII Torr. Root fibrous; leaves few, lance-oval, abruptly pointed, sheathing at base, veins running from base to apex; scape taller than the leaves, bracted, bearing 2—4 umbels, the terminal 10—20-flowered, the lateral 2—4-flowered; flowers bell-shaped, yellowish, 8'' long; segments obtuse; berries 3-celled; cells 8—10-seeded.—Mountain woods near Santa Cruz to the Russian R. A handsome plant, 1—2 f. May.

C. UNIFLORA Kunth. Root tuberous; leaves 2 or 3, lance-oblong, abruptly pointed, margins ciliate; scape not longer than the leaves, bearing one large white flower; segments same shape as the leaves, 10'' long, stamens shorter; berry obovoid, as large as a pea, 9-seeded, blue.—Northern declivities of Mt. Hood (Mr. Brazee), Cascades to Vancouver! June, July.

MAJANTHEMUM BIFOLIUM DC. *β. dilatatum*.—From Astoria to the Dalles, north and east. Leaves generally 3, broad-cordate, 3—5' diameter! Stem 6—10'. Exactly like the eastern plant, except its gigantic size. June. (*Smilacina dilatata*, Nutt.)

Tribe IV.—UVULARIÆ.

PROSARTES HOOKERI Torr. Stout, leafy, scabrous-puberulent; leaves broadly ovate, acuminate, deeply cordate-amplexicaul; umbels 3—4-flowered, segments spatulate, obtusish; anthers oblong, glabrous; stigma entire.—Santa Cruz to Oakland hills, &c. 2 f. Leaves 2' broad, strongly veined. Stem and branches reddish, pubescent. Flowers greenish-yellow, 9'' long. April. (*Uvularia lanuginosa*, *β. major* Hook.)

P. MENZIESII Don. Nearly glabrous; leaves lance-oblong or ovate acuminate, sessile, or subcordate-clasping; umbels terminal, 1—3-flowered; flowers bell-shaped, pendulous, as long as their stalks; segments linear-lanceolate, acuminate (6''), the stamens often longer, and the slender style still longer; berry lemon-shaped, orange-colored, with 6 rounded seeds.—Santa Cruz to the Columbia. Stem 2 f., erect to first branch, then secund. Flowers greenish. May. (*Uvularia* Hook.)

STREPTOPUS AMPLEXIFOLIUS DC.—Washington Co., Oregon (Mr. E. Walker). Glabrous. Leaves glaucous beneath. Berries red, oblong, 15—21-seeded.

Notice of some VERTEBRATE REMAINS from Harden Co., Texas.

BY JOSEPH LEIDY, M. D.

The following described fossils were submitted to my examination by Messrs. Geo. N. Lawrence and D. G. Elliot, of New York. They are reported to have been obtained from blue clay and sand, beneath a bed of bitumen, in Harden

[June,

Co., Texas, and were donated to the New York Lyceum of Natural History by Mr. Robertson. The fossils are mostly thoroughly permeated with bitumen; others slightly.

EQUUS COMPLICATUS.

1. A first superior molar. Length along the inner median column $2\frac{1}{2}$ inches; antero-posterior diameter of the triturating surface 20 lines; transverse diameter, independent of the cementum, $13\frac{1}{2}$ lines. It nearly resembles the specimen represented in fig. 9, pl. xv, of Holmes' Post Pliocene Fossils of South Carolina.

2. A last superior molar, curved to a remarkable degree. Length along the inner median column, less the fang, 2 inches 1 line; antero-posterior diameter of triturating surface independent of cementum 18 lines; transverse diameter do. $10\frac{1}{2}$ lines; length of curve antero-externally 35 lines, postero-externally 16 lines.

3. An upper temporary molar. Length internally $10\frac{1}{2}$ lines; antero-posterior diameter 17 lines; transverse diameter $9\frac{1}{2}$ lines.

4. A fragment of a fourth upper molar.

5. The upper part of the crown of a last lower molar. Antero-posterior diameter $15\frac{1}{2}$ lines; transverse diameter, independent of the cementum, $5\frac{1}{2}$ lines.

6. A fifth inferior molar. Length antero-internally to division of fangs 33 lines; antero-posterior diameter 13 lines; transverse diameter, independent of cementum, 6 lines.

All the above are completely imbued with bitumen, which has penetrated the cementum and dentine throughout.

7. Fragments of a lower jaw, with the first molar tooth. This specimen is only partially impregnated with bitumen. The length of the tooth is 33 lines; the antero-posterior diameter 17 lines; the transverse 7 lines.

MASTODON AMERICANUS. *M. ohioiticus* or *M. giganteus* of authors.

A small fragment of a molar.

MEGALONYX VALIDUS, D. S.

A portion of a tooth resembling most in its form the second upper tooth of the *Megalonyx Jeffersoni*, but much larger than in the mature individuals of that species. The transverse diameter is $15\frac{1}{2}$ lines; the antero-posterior $11\frac{1}{2}$ lines. The transverse section is quadrate. The anterior surface is nearly a transverse plane; the posterior surface forms a plane inclining outward; the inner surface is nearly a plane inclining forward; the outer surface forms with those in front and behind a semi-circle. The triturating surface is comparatively slightly concave, and inclines postero-internally. Its anterior border is the most prominent; the posterior being comparatively so little prominent as not strikingly to interfere with the slope of the surface. The specimen is thoroughly impregnated with bitumen.

FELIS (TRUCIFELIS) FATALIS, D. S.

An upper sectorial molar, contained in a small fragment of the jaw, which also includes the socket for a single fanged tubercular tooth. The specimen is thoroughly saturated with bitumen.

The sectorial tooth indicates a feline animal, approaching in size the lion or Bengal tiger. The form of the tooth is nearly like the corresponding one of the latter animals, but the crown is of less width and proportionately longer. The anterior lobe differs from that in the true cats not only in a greater proportionate development, but in its distinct separation in two sub-lobes, of which the anterior is rather more than half the depth of the succeeding one. The measurements of the tooth, in comparison with those in a similar one of a large skull of the Bengal tiger, are as follows:

1868.]

| | Fossil. | Tiger. |
|--|------------|-----------|
| Breadth of crown..... | 15½ lines. | 18 lines. |
| Depth at anterior lobe..... | 7 " | 7½ " |
| " at principal cusp..... | 9 " | 9 " |
| " of posterior lobe..... | 6½ " | 7 " |
| Width at antero-internal abutment..... | 7½ " | 8½ " |

CANIS.

An upper lateral incisor, impregnated with bitumen. The tooth is unworn, and is intermediate in size with those of *Canis occidentalis* and *C. latrans*. The unworn crown is 6½ lines long, its antero-posterior diameter 3½ lines; its transverse diameter 3 lines. The compressed fang, broken at the end, has been about 13 lines long; its width is 4½ lines; its thickness 2½ lines.

Undetermined.

An ungual phalanx, apparently of an edentate animal. The end is broken off, and the specimen is thoroughly imbued with bitumen. The length is uncertain, for we cannot determine whether it was blunt or pointed at the end. Supposing it to have been in the former condition, it has been about 28 lines long. The breadth is more than half the length, and is much greater than the depth or thickness. The bone is without sheath, transversely oval in section, 13½ lines wide by 10 lines in depth. The articular facet forms a trochlear concavity, with vertical median elevation, and is directed backward and downward. About one-fourth of the length from the base it expands, and then gradually narrows forward to the apex. The upper surface forms an inclined plane forward, and is convex transversely, and smooth. Its greatest width just back of the middle is 16 lines. The under surface is convex transversely, and slightly so in the length. On each side of this surface, just in advance of base, there is a large vasculo-neural foramen, penetrating to the interior of the bone. A wide but shallow groove curves forward between the foramina, and a deeper one diverges from each laterally and backward. The lateral borders of the ungual expansion are obtuse.

Undetermined.

A bone of uncertain character, but resembling a phalanx. Slightly impregnated with bitumen. It is a curved, four-sided pyramid, with a square plane base, truncated deeply at one angle. A strong boss occupies the incurvature of the bone at the base, and at the side of the truncated angle. The border of the pyramid along the convexity opposite the latter is likewise truncated. The bone in the structure of its surface looks as if it might be of reptilian character, exhibiting everywhere a rather conspicuous vascular porosity. The length of the specimen in the axis is 16 lines, the diameter of the base 11 by 10½ lines.

EMYDES.

Small fragments of the carapace and sternum of several species of emydes, thoroughly imbued with bitumen. Most of the fragments are too imperfect to characterize the species, but some of them indicate an animal about the size of the living *Emys scabra* of the southern States, but evidently a different species, as the bones are proportionately much more robust. The fore part of the sternum differs from that of *E. scabra* in the abrupt projection forward of the inner division of the episternals. A pair of these together at the articulation of the hyposternals give a breadth of 43 lines; depth of the episternals to the entosternal 13 lines; projection forward of the part covered by the gular plates 4 lines; greatest thickness 5½ lines. A hyposternal about its middle is 28 lines from before backward; 26 lines in width behind the inguinal notch; and 6 lines where thickest internally. The fore part of a nuchal plate resembles the corresponding portion in *E. scabra*, but is more deeply indented. Its width anteriorly is an inch; the length of its median column 10½ lines; its thickness where greatest 6 lines. The species may be distinguished by the name of

EMYS PETROLEI,

Probably belonging to the subgenus *Trachemys* of Agassiz, like *Emys scabra*.

[June,

Indication of an **ELOTHERIUM** in California.

BY JOSEPH LEIDY, M. D.

ELOTHERIUM SUPERBUS, n. s.

Prof. Whitney recently placed in my hands for examination a tooth of a supposed carnivorous animal, from Douglas Flat, Calaveras Co., California. It was derived from a stratum of the same age as that from which a lower jaw of *Rhinoceros hesperius* was taken. The tooth appears to me to be the right upper lateral incisor of a species of *Elotherium*, perhaps the same as *E. ingens* of the Mauvaises Terres of White River, Dakota, though it would appear to belong to a larger individual than the remains referred to the latter, if not to a yet larger species. The crown of the tooth is conical, compressed from within outwardly, and subacute laterally. The apex is rounded; the base somewhat expanded, and at its fore part produced in a short embracing ridge. The fang is conical and curved. The measurements of the specimen are as follows:

Length of tooth in straight line $29\frac{1}{2}$ lines; length of crown 13 lin.; breadth 9 lin.; thickness $6\frac{1}{2}$ lin.

Notice of some **REPTILIAN REMAINS** from Nevada.

BY JOSEPH LEIDY, M. D.

Prof. J. D. Whitney has submitted to my inspection some fossils derived from the Triassic rocks, of Star Cañon, Humboldt Co., and from the Toiyabe Range, north-east of Austin, Nevada. The specimens are very imperfect, but nevertheless interesting, and sufficiently characteristic to indicate apparently three distinct reptiles having an affinity to *Ichthyosaurus* and *Eosaurus*, nor am I prepared to prove that they do not belong to one of these.

The fossils have been and are yet partially imbedded in a dark bluish siliceous limestone, and the same material has so completely infiltrated the bones that they almost appear like modified portions of the same rock.

One of the specimens consists of a mass of rock containing two vertebræ and parts of two others in series. The same rock includes two shells, which appear to be *Ammonites Blakei*, Gabb, and *Posidonomya stella*, Gabb. The specimen is from New Pass, in the Toiyabe Range, north-east of Austin. The body of the vertebræ is deeply biconcave, as in *Ichthyosaurus*. The length is considerably less than the breadth. The under side is plane fore and aft, but the margins are slightly prominent and bevelled. The sides are slightly concave, and provided with a short and robust process for the head of a rib. The neural arch with its spine, visible in one vertebra along the broken margin of the specimen, rises above the body about one and a half times its depth, and its abutment exhibits the remains of another articular process for the rib. The neural canal is triangular. The measurements of the vertebræ, partially estimated, are as follows:

| | |
|--|-----------|
| Length of body inferiorly..... | 11 lines. |
| Depth of body..... | 16 " |
| Width..... | 16 " |
| " including costal processes..... | 21 " |
| Height of neural arch, including spine from upper part of body, obliquely..... | 28 " |
| Height of neural canal..... | 8 " |

A second specimen from Star Cañon, Humboldt Co., consists of a series of eight vertebræ, partially included and held together in the matrix, and much weather-worn where they have been exposed. The vertebræ may be part of the caudal series of the same animal as the above, but the matter is uncertain. The eight vertebræ together have a length of 58 lines, making about $7\frac{1}{2}$ lines for each.

1868.]

A third specimen from the Toiyabe Range, on the Reese River, north-east of Austin, consists of the isolated body of a vertebra, somewhat distorted, ground off at one of the articular faces, and less infiltrated with the rocky matrix than the others. It appears to have corresponded in proportions with those of the series last noticed. It is biconcave, moderately concave at the sides, nearly plane below, presents the remains of two short oblong articular processes for ribs near the position of the neural arch, the sutural impressions of which are visible above. The length has been about 8 lines, the breadth about 16 lines. The neural canal about 2 lines wide.

The very imperfect condition of the specimens renders me unable to say more about them, nor is it certain that they all belong to the same animal, but for the present I propose to consider them so, under the name of *Cymbospondylus piscosus*.

Of the remaining specimens, three consist of the greater portion of three vertebral bodies, which belonged in series and have been broken apart. These are labelled Humboldt, Nevada. They apparently indicate a much larger species of the same genus as the former, the vertebral body having the same form. The sides of the articular funnels are convex outwardly from the centre, which deepen more rapidly at the inner third of the surface. One specimen retains the neural arch without its spine, and a short, robust, costal process, extending from near the bottom of the arch almost half the depth of the body. A second vertebra is singularly distorted, apparently as if the bone had been in a plastic condition. The measurements of these vertebræ, partially estimated, are as follows:

| | |
|-----------------------------------|-----------------|
| Length inferiorly..... | 17 to 18 lines. |
| Depth of body..... | 44 " |
| Breadth " | 44 " |
| Depth of costal process... .. | 21 " |
| Projection of costal process..... | 4 " |

For this species I propose the name of *Cymbospondylus petrinus*.

Another specimen, consisting of a mutilated vertebral body from Star Cañon, Humboldt County, indicates an Enaliosaurian, apparently not only differing from either of the former, but probably belonging to a different genus. The specimen is broken away at the top and at one side, is also somewhat mutilated on the opposite side, and appears considerably eroded on one articular face. The body is deeply biconcave, as in *Ichthyosaurus*, but proportionately much longer in relation with the breadth. The funnel-like surfaces are convex outwardly from the centre, and deepen more rapidly at the inner third. The sides and under part of the body are slightly concave fore and aft, and defined by acute borders. The under part exhibits a square depressed appearance from the presence of four angular chevron processes, associated fore and aft by sub-angular ridges. The estimated size of this specimen is as follows: Length of the body inferiorly 2½ inches; depth 4½ inches; breadth about 3 inches.

For this animal I propose the name of *Chonespondylus grandis*.

Notice of some VERTEBRATE REMAINS from the West Indian Islands.

BY JOSEPH LEIDY, M. D.

Some time since Prof. Felipe Poey, of Havana, sent to me several fossils, together with a copy of a pamphlet entitled "De la Existencia de grandes Mamíferos Fósiles en la Isla de Cuba. Par D. M. F. de Castro. Habana, 1865."

The fossils consist of the vertebra of a crocodile and part of a costal plate of a turtle, which were found with other bones, together with the lower jaw of a giant sloth, at Ciego-Montero, Cienfuegos, Cuba.

The reptilian fossils are as follows:

[June,

CROCODILUS PRISTINUS, n. s.

A posterior dorsal vertebra of mature age, but without its neural arch, except the greater portion of one abutment. The body is slightly shorter, and absolutely very much broader and moderately deeper than in the corresponding vertebra of the Mississippi alligator. It also more rapidly narrows posteriorly, but proportionately presents about the same degree of concavity from before backward at the sides and beneath, where it is also in like manner smooth. The anterior articular surface is of considerably greater breadth than height, so as to present a transverse ovoidal outline. The measurements of the specimen are as follows: Length in the axis 23 lines; inferiorly 19 lines. Height anteriorly 19 lines; breadth 24 lines. Estimated height posteriorly 17 lines; breadth 21 lines. Thickness of neural abutment anteriorly 12 lines. I have not the means of comparing the fossil with vertebrae of either species of the living crocodiles of Cuba, so that I cannot say whether it belongs to one of them or not. It is too large to belong to *C. rhombifer*, according to the dimensions given by Dumeril, but would perhaps accord with *C. acutus*. As an associate with a *Megalonyx*, it is not unlikely that it belongs to an extinct species, for which the name leading this article is proposed.

TESTUDO CUBENSIS, n. s.

Indicated by a portion of what I suppose to be the first costal plate of the right side. It is marked by the lateral borders of the first and second vertebral scutes and their transverse separation. Along the former borders the plate is 51 lines, and along the latter separation 16 lines. The articular border with the first vertebral plate is 30 lines; that with the second vertebral plate 14 lines. The articular border from the first vertebral plate to the lateral groove defining the first vertebral scute is convex forward and inward, and 14 lines in a direct line. A strong costal process projects from the under part of the plate nearly parallel with its length. The surfaces corresponding with the vertebral scutes are somewhat depressed, and generally everywhere are nearly smooth, or without markings so conspicuous as to affect the investing scutes. The greatest thickness of the bone is where it articulated with the first and second marginal plates, measuring from $3\frac{1}{2}$ to $4\frac{1}{2}$ lines; and where thinnest it measures only one line.

No living *Testudo*, I believe, at present inhabits Cuba, and the fossil probably indicates a species cotemporary with the *Megalonyx*.

The pamphlet above mentioned contains a notice of remains of the horse, hippopotamus, and of a giant sloth, found in Cuba.

The remains of the horse appear not to differ from the corresponding parts of the recent animal, and it is even doubtful if they are to be considered indigenous fossils.

The remains of hippopotamus, consisting of isolated canines, probably also belong to the recent animal. An inferior canine, described and figured by De Castro, certainly presents nothing peculiar. Formerly dentists employed the canines of the hippopotamus for the construction of artificial teeth, but since the introduction of porcelain teeth they have been thrown aside. Occasionally such specimens have been brought to me as supposed fossils, and perhaps the Cuba specimens are of the same character.

The most interesting fossil described by De Castro consists of the greater part of a lower jaw of a giant sloth, which was found in association with a number of reptilian bones, of which those above described are specimens, at Ciego Montero, Cienfuegos. The figures accompanying the description, though drawn in unfavorable positions for satisfactory comparison, nevertheless clearly indicate a lower jaw of nearly the same form, and teeth holding the same relative position as in *Megalonyx*. As in this genus the anterior large caniniform molar is widely separated from the posterior three small molars, which differ from those of *Megalonyx Jeffersonii* only specifically. From the dimensions given, the jaw belonged to a smaller animal than the latter. The caniniform
1868.]

molar differs remarkably from that of *M. Jeffersonii* and *M. dissimilis*, as is also the case compared with that of *Lestodon armatus* and *L. myloides* of Buenos Ayres. In transverse section it is reniform or crescentic with blunt poles, and the biting extremity appears to have been worn off in the same manner as the incisors of a Rodent, to which, indeed, the jaw appears first to have been supposed to belong. The species may be named *MEGALONYX RODENS*, or, if the peculiarities of the caniniform molar be regarded generically distinct from those of *Megalonyx* and *Lestodon*, it may be named *MEGALOCNUS RODENS*.

EMYS SOMBRERENSIS, n. s.

The bones of extinct species of turtle are not unfrequently found in the so-called Sombrero guano, Sombrerite or Ossite, a material rich in phosphate of lime, largely mined in the island of Sombrero, W. I., and used in the preparation of a fertilizer for agricultural purposes. In a mass of this material presented to the museum of the Academy (see Proc. 1859, 111), the posterior part of the plastron of a species of *Emys*, or perhaps *Testudo*, is perceived, for which the above name is proposed. The specimen consists of both xiphisternals and the greater portion of both hyposternals, articulated in natural juxtaposition. Other fragments of the plastron and carapace, together with a portion of a thigh bone, are also contained in the mass. The specimen indicates the sternum to have approximated a foot in length; and the breadth at the lateral sutures of the hyposternals has been about $7\frac{1}{4}$ inches. The under surface of the sternum is flat and smooth; and laterally it curves but slightly upward. The posterior sternal notch is two-thirds as deep as the width, and almost forms an equilateral triangle. The postero-lateral border from the inguinal notch to the rounded triangular ends of the xiphisternals, is bow-like, or presents two concavities with an intervening convexity. The caudal scutes are small, reaching slightly beyond the bottom of the sternal notch. The femoral scutes are on a level with the inguinal notches. Estimated length of hyposternals in the median suture 35 lines; breadth 45 lines. Length of xiphisternals in median suture 17 lines; greatest length about middle 25 lines; breadth along anterior suture 28 lines. Length of caudal scutes internally 13 lines; externally 10 lines. Length of femoral scute internally 25 lines. The bones present about the ordinary proportion of thickness observed in emydes.

July 7th, 1868.

DR. BRIDGES in the Chair.

Twenty-one members present.

The following papers were presented for publication:

"Notice of some remains of Horses." By Joseph Leidy, M.D.

"Notice of some extinct Cetaceans." By Joseph Leidy, M.D.

"Mitchella repens; a Dioecious plant." By Thomas Meehan.

July 14th.

The President, DR. HAYS, in the Chair.

Nineteen members present.

The following papers were presented for publication:

"Second contribution to the history of the Vertebrata of the Miocene period of the United States." By Edw. D. Cope.

"Remarks on Conosaurus." By Joseph Leidy, M.D.

"Remarks on a jaw fragment of Megalosaurus." Jos. Leidy, M.D.

[July,

E. D. Cope exhibited the vertebra of an extinct reptile, from the middle green sand bed of New Jersey ; which possessed the peculiar articular structure known as the zygantrum and zygosphen. He said the form was in some degree like that of certain modern terrestrial genera of Iguanidæ, as the genus Euphyryne, Baird, but it appeared to have some affinity to *Macrosaurus*, Owen, in form. The animals, if similar in proportions to the Iguanæ, would have been some twelve feet in length. It was called *CLIDASTES IGUANAVUS*.

A Mosasaurid reptile was indicated also by a single vertebra from Medford, N. J., also from the middle bed. It was distinguished from other forms of the family by its compressed elevated form. It was assigned to a species named *NECTOPORTHEUS VALIDUS*.

The structure of the vertebral column in *Elasmosaurus* was pointed out. It was stated to possess apparently no zygapophyses throughout its whole length, but in place of these, the zygosphen and zygantrum articulation. The articulations of the vertebræ were therefore the reverse in respect to direction of their surfaces from the usual form among vertebrata. In fact the structure of the genus was shown to be entirely new and peculiar among vertebrated animals. The genus *Cimoliasaurus*, Leidy, was stated to exhibit the same structure, and required that the vertebræ should be reversed in order to read their connections correctly.

Thomas Meehan said he had proposed to himself to contribute a paper to the American Academy of Science which meets next month in Chicago, on the leaves of Coniferæ ; but some friends here acquainted with his intention, and interested in the facts, were desirous he should explain to them some of the leading points, which he would with pleasure do.

His chief position was that what are usually considered the leaves of Coniferæ are but a part, and frequently the least important part of the true leaves, which are either mostly adherent or mostly free according to the vigor of the branch or individual plant, and not according to any specifically constitutional character ; and that a recognition of this fact is of great importance in determining the limits of genera, species and varieties of the Order. He exhibited specimens of the *Larix Europæa*, pointing out that it had two classes of leaves, the one entirely free, the other mostly adnate to the stems. The adnate leaves were on the elongated shoots, the free leaves on the arrested shoots or verticills ; on the elongated shoots the leaves also had a power of elongation, and produced the green awl-shaped points we commonly called leaves. On the arrested shoots or spurs, the leaves had no power of elongation. They were obtuse, rather spatulate, just the same as the adnate portion—the true leaves—on the stem. The theory he deduced from this was that *adnation was a characteristic of vigor ; free leaves a condition of weakness or arrested growth*. This explained the polymorphous character of many Coniferæ. The rule operated through many genera. He exhibited strong branches of *Cryptomeria japonica*, on which the leaves were united for four-fifths their length, and weaker ones on which four-fifths were free, &c. The same occurs on *Juniperus virginiana*, *Juniperus communis*, *Thuja orientalis*, *T. occidentalis*, and other species. Wherever the shoots were delicate, either constitutionally or by growing in the interior of the plant and deprived of their due share of light, the leaves were free ; wherever the contrary existed, and the shoots were vigorous, adnation in a greater or less degree prevailed. In many species this polymorphous condition could be produced at will, by weakening the plant. Cuttings of *Thujopsis borealis* made from branches with adnate leaves, would throw out shoots with free leaves until they were very well rooted and able to throw out vigorous shoots.

A test of vigor was the power to branch. Only on vigorous maturity did the branching age of trees commence. *Arbor vitæ*, when mature, pushed out branches from the axils of every other pair of leaves. This gave them their fan-like appearance. When young they branched little, and this stage was always 1868.]

marked by more or less free leaves. *Thuja ericoides* of gardens, with its heath-like foliage, was a weakly constituted form, which retained its childhood foliage, and had little disposition to branch. *Thuja meldensis* of Lindley, which from its peculiar appearance that learned author supposed to be a hybrid between the red cedar and Chinese arbor vitæ, was a form of intermediate vigor, branching moderately, and leaves intermediately adnate. *Retinispora ericoides* of Zuccarini, was also a weak form with free leaves, the well developed form of which he had had no opportunity to trace with certainty. *Taxodium distichum* Richard, and *Glyptostrobus sinensis* Endl., were no doubt the same thing. He showed, by the vigorous branching character of the latter, the necessity for the arrested foliation it presented, and exhibited specimens of vigorous (more branching) *Taxodium distichum* in which the leaves were abbreviated and twisted around the stem, exactly as in *Glyptostrobus*, except that the free parts were rather longer. This form did not branch quite as much as the typical *Glyptostrobus*, but more so than in the typical *Taxodium*.

He remarked that the two genera *Pinus* and *Sciadopitys* had their true leaves adpressed almost entirely to their branches, and illustrated this by specimens of *Pinus austriaca*. Instead, however, of these genera developing green free points on the apices, they pushed out rather abortive branches from the axils of the true leaves. The fascicles of leaves on these plants were not true leaves, but were intimately connected with the axial system of the plants. The adpressed true leaves on the pine were annual, although as dead epidermis they remained often on the bark until the regular exorticating period arrived; but these so-called leaves, or rather metamorphosed branchlets, remained often several years. He had known some remain eight years. Their connection with the axial system could be seen by raising the bark of a three or four year old branch on the Austrian pine.

Mr. Gabb made some remarks about Kitchen Middens, in the vicinity of San Francisco and on the shores of San Francisco Bay, his attention having been called to the similarity between them and those observed by Dr. Leidy, near Cape Henlopen. He also mentioned a curious circumstance for which he had been unable to account. In various places on the coast of both Upper and Lower California, he had observed shells, often of the heavier species, scattered over the surface in great profusion, and occasionally to a distance of several miles from the beach. They were evidently of very modern origin, being strewn on the surface of the soil, but whether they had been carried there by man or birds, he had never been able to discover.

Dr. Wm. L. Wells made some observations on the mode of scattering the spores of the *Polypodium vulgare*. Under the microscope the sporangium could be seen to open at a point near its stem; and the opening grew very slowly larger, until the continuation of the stem which previously encircled the sporangium was nearly straight. It then suddenly sprang shut with a jerk, which scattered the spores in every direction, and which usually sent the sporangium itself out of focus. In the cases in which it was not thrown entirely out of focus, the same operation could be seen to be repeated two or three times. In no case were any spores scattered during the opening, which always took place very slowly.

July 21st.

The President, DR. HAYS, in the Chair.

Fourteen members present.

The following paper was presented for publication:

"On the Crocodilian genus *Perosuchus*." By Edw. D. Cope.

[July,

Mr. Gabb made some remarks on a small lot of fossils submitted to him by Prof. Orton. The fossils are small, and all belong to undescribed species. They are of unusual interest, being the first fossils, so far as he was aware, ever found in the immense clay deposits of the Amazon Valley—the Tabatinga Clay. The fossils indicate a marine origin for this clay, all of the genera being essentially salt-water forms. They were found by Prof. Orton in a bluff showing a fine section of about fifty feet in height, at the town of Pebas, on the Amazon River, two miles above where it joins the Marañon.

July 28th.

DR. J. GIBBONS HUNT in the Chair.

Fifteen members present.

The following gentlemen were elected members: Geo. Roberts, M.D., Mr. Levi Taylor.

The following were elected correspondents: S. Spencer Cobbold, M.D., of London, W. Kitchen Parker, of London, Rev. Samuel Haughton, of Dublin, Alphonse Milne Edwards, of Paris, Wm. T. Brigham, of Boston.

On favorable reports of the committees, the following papers were ordered to be printed:

MITCHELLA REPENS, L., a dioecious plant.

BY THOMAS MEEHAN.

A few weeks ago I had the honor of pointing out to the members of the Academy that *Epigæa repens* was a dioecious plant. I have now to report a like discovery in *Mitchella repens*.

In the case of *Epigæa* I had to indicate the polymorphism accompanying the divisions of the sexes, as part of the discovery; in the present instance Dr. Asa Gray is before me in noting the distinct appearances; the originality of my own observation lies merely in giving the meaning of the facts already recorded. In the last (5th) edition of Gray's Manual, speaking of *Mitchella*, the author says, "Flowers occasionally 3—6, merous, always dimorphous, all those of some individuals having exerted stamens and included stigmas,—of others included stamens and exerted style." Although this statement expresses the appearance, it is not strictly accurate; for the pistil in the one case is not perfect, and in the other the anthers are mere rudiments, without a trace of pollen in any that I have examined. The two forms are truly male and female plants.

In the female plant the pistil, with its well-developed stigma, projects one-eighth of an inch beyond the throat of the corolla. The small rudimentary anthers are sessile, and hidden among the coarse down of the corolla tube, so as not to be seen without dissection.

In the male plant it is the rudimentary pistil which is confined in the villous tube, far out of reach of pollen influence, if even it were perfectly developed. On the other hand, the anthers are borne on filaments which are free from the corolla for one-eighth of an inch, and projecting that much beyond the corolla throat.

In the case of *Epigæa* I had to record many variations in the form and proportions of the floral parts. *Mitchella* is as remarkable for uniformity; except that the calyx teeth in the male are coarser than in the female, there is little variation from one type. Dr. Gray observes that the lobes of the corolla 1868.]

vary from three to four, five, and six. I may add that five-lobed corollas are common, and these are usually accompanied by five anthers.

The number of male plants is about equal to the female; occasionally plants of the separate sexes intermix. I, and probably others, have often noticed in the fall some patches bearing abundantly, other patches without a berry. The facts I now offer afford the solution.

In reference to *Mitchella*, it may not be out of place to correct an error in Lindley's "Vegetable Kingdom." The learned author includes in his natural order Cinchonaceæ *Mitchella*, *Cephalanthus*, *Diodia*, *Oldenlandia* and *Spermacoce*,—all high northern plants; and yet, when speaking of the geography of the order, writes that "the most northern species in America is *Pinckneya pubens*, inhabiting the Southern States of North America."

Second contribution to the History of the Vertebrata of the Miocene period of the United States.

BY E. D. COPE.

A visit to the Miocene region of the western shore of Maryland, has explained to the writer more clearly the stratigraphical position of the vertebrate fossils described in this and preceding essays on the subject.

The miocene deposit which contains the fossils, consists of a dark sandy clay, varying from a leaden to a blackish color, through which water does not penetrate. Its upper horizon may be traced along the high shores and cliffs of the Chesapeake by the line of trickling springs which follow its upper surface. The bottom I have not seen, and cannot give its depth, but a great bed of shells occurs at from fourteen to twenty-two feet below its upper horizon. This consists of, first, two separate shallow strata of shells, and about four feet below the upper, a heavy bed at the depth mentioned. The lesser beds vary in amount, being sometimes wanting.

The streams of the country either flow on or cut the shell beds, and display their washings, as teeth of sharks, cetaceans, etc. The bones generally occur at or near the level of the upper line of shells. The remains of the large whale, the *Eschrichtius cephalus mihi*, lay across the bed of a small run and penetrate the bank, where I saw the remainder of its vomer, of which I have the half; with numerous other parts of the cranium added since the description of the species, it was dug out by my energetic friend Jas. T. Thomas, whose evidence as to the pertinence of the various pieces described to the same animal is conclusive. It is, if need be, confirmed by the white color and porous texture of them all, a character not noticeable in other large whale remains procured by him. Apparently pertaining to a genus known as fossil only from the European drift, it becomes important to be sure of its Miocene origin. This must be admitted; it lay together as originally deposited, just below the upper shell line, and did not extend so far down as the great bed, from 10 to 18 feet below the top of the blue loam. The upper line of the latter has been varied, inland, by the various operations of erosion, etc. In some places it forms the bottom of vallies, which are excavated almost to the shell line. In such a situation, about 3½ feet above the great shell bed, and a few inches below the surface on the side of a creek, the bones of *Galera* and *Dicotyles* occurred.

BASILOSA URID.E.

CETOPHIS Cope.

This genus rests upon the evidence furnished by caudal vertebræ in the collection. They present an approximation to *Basilosaurus* in the great thickness of their epiphyses. In the more elongate vertebra each epiphysis will measure the third the length of the centrum deprived of them; in the less elongate, they measure one-half the same; in the shortest, more than half the

[July,

remaining centrum. One extremity of the vertebra is flat, the other strongly convex, and none have any trace of diapophyses. The neural arches have been partly broken away, but have been similar to those of other genera, while the groove that marks the inferior aspect of caudal vertebrae is normal. In two vertebrae, the longest and shortest, the foramina which usually pierce the sides of the centra vertically, issue below, within the basal groove and above, below and outside the basis of the neurapophysis. In another specimen the foramen opens outside the inferior sulcus, and in one there is no foramen at all. These structural features indicate a genus of general peculiarity, and perhaps allied to *Basilosaurus*. There may be some question as to whether two species are not represented among the vertebrae.

CETOPHIS HETEROCLITUS Cope.

The four specimens may represent a proximal, a median, and a distal caudal of one individual, and a median caudal of another. They were not adult, as the epiphyses are entirely separable. The longer or proximal caudal is sub-hexagonal in section, the median depressed, and the smallest round in section. The larger median is nearly round in section. The epiphysis instead of retreating before a process of the centrum opposite the four apophyses, as in *Ixacanthus*, advances on the centrum at these points. The inferior groove of the centrum is deep on the first and shallower on the succeeding; obsolete on the last. The neural canal about as large on the proximal as in anterior caudals generally.

| | In. | Lin. |
|---------------------------------|-----|------|
| Length longest..... | 3 | 3·8 |
| Height flat articular face..... | 2 | 1 |
| Width do. do. | 1 | 11· |
| Length median (smaller)..... | 2 | 6·3 |
| “ without epiphyses..... | 1 | 1·5 |
| Height flat face..... | 1 | 9 |
| Width “ | 1 | 9·2 |
| Length median (larger)..... | 3 | 1·2 |
| Width flat face..... | 2 | 5 |
| Length smallest..... | 2 | 1 |
| “ without epiphyses..... | | 11· |
| Height flat extremity..... | 1 | 10·5 |
| Width do. do. | 1 | 11· |

From Charles county, Maryland. From Jas. T. Thomas, Mus. Academy.

The convex articulation of the vertebrae would suggest a greater flexibility of the column in this part than is usual among Cetacea, but more as in cervical vertebrae of long-necked mammals, and in reptiles. The absence of diapophyses would confirm such an indication. Were it not for the inferior groove the longer vertebrae above described might be taken for a lumbar, and it may be such, as in the *Zarhachis flagellator* a similar form coexists with the usual form of diapophysis of that part of the column. There is probably some distant affinity between the two genera.

With respect to the genus *Basilosaurus*, it may be noted that the *Polyptychodon interruptus* of Emmons, must be regarded as established on one of its canines. Whether the species be the *D. cetoides* must be left for their examination. A fine specimen is in the Museum of the Mount Holly Lyceum of Natural History.

In the description of the *Cynorca proterva* (in Proceed. Acad. 1867,) misled by the extraordinary resemblance to Giebel's plate quoted, I unfortunately mingled with its molar and premolar teeth, the canine of small *Dicotyles*. This point, suggested to me by Leidy, I have no doubt is the case. It will be necessary therefore to add the following details of character of the characteristic molar and premolar, which I described too briefly (p. 151): “Molar with two roots. Premolars with short conic crowns. Premolars compressed,

1868.]

cutting. Roots of premolars compressed." (P. 152): "Two teeth having crowns similarly though rather more symmetrically formed, I suspect to have occupied that position," i. e. "between molars and premolars."

The premolar first mentioned is about .8 in length, the crown slightly striate. The anterior molar has two roots, which are united some distance below the crown. The crown exhibits no denticles, and is not more elevated than the antero-posterior diameter of its base. This tooth, as well as the other, is of small size, and indicates the smallest species of the family.

The *Pontogeneus priscus* Leidy, which I referred, in accordance with a printed suggestion of Leidy's, to the *Zeuglodon pygmaeus* Müller, on examination proves to be a Delphinoid. The species of Müller is not only generically distinct from *Basilosaurus*, but from *Doryodon* also, to which I referred it,* if it be regarded as established on the cranium figured by Gibbes in the *Journal of the Academy*.

DELPHINIDÆ.

Among the vertebræ of the species of this family collected by Jas. H. Thomas in the Miocene marls of Charles county, Maryland, may be recognized those of five genera, as follows:

- The caudal vertebræ broader than long; lumbrars, sacrales and caudals nearly similar; diapophyses of lumbrars and caudals flat dilated, the latter with vertical foramen.....DELPHINUS.
- The caudals longer than broad, slender; diapophyses broad, of caudals perforate.....DELPHINAPTERUS.
- The caudal vertebræ longer than broad, lumbrars and caudals with flat diapophyses which are not perforate.....ZARHACHUS.
- The lumbrars, dorsals, and caudals elongate, narrower than long; the diapophyses of some of the lumbrars and of the caudals narrow and spinous, and not perforate; epiphysial face plane.....PRISCODELPHINUS.
- The lumbrars and dorsals shorter, the diapophyses of both posterior lumbrars and caudals narrow and subcylindric, not perforate; epiphysial face grasping the epiphysis by four processes, one opposite each neur- and one opposite each diapophysis.....IXACANTUS.

We find a serial relation among the Dolphins of this period, and exemplified in the characters of the above genera. In *Tretosphys* the diapophyses are all flat as in Dolphins, generally many of the caudals perforate, with a vertical foramen at the base as in them. This is succeeded by a genus in which the blood vessel which in the former passes through this foramen runs round the front of the base of the diapophysis. In the next form some of those of the caudal vertebræ are narrower, and the posterior subcylindric and spine-like; in the last genus of the series the diapophyses of all the caudals and many of the lumbrars have the same spinous form. There is also a relation of a similar kind in the forms of the beak of Miocene Dolphins. All are elongate, some very narrow and prolonged, and some a cylindric beak only toothed at the base, (*Rhabdosteus* Cope). It is an interesting object of inquiry to determine whether the relation of structure of the processes in any way coincides with that seen in the muzzle.

A point to be noticed in our Miocene Dolphins, as compared with the *Inia*, *Beluga*, *Delphinus* and *Phocæna* of the present period, is the universally increased length of the vertebræ of the posterior part of the vertebral column. Those species named here *Delphinapterus* resemble in their dorsal vertebræ the *Belugas*, but the caudals of some, instead of being shortened, as in the latter, do not diminish in length. This points to a more slender form, and with the narrowed diapophyses and increasing thickness of the epiphyses constitutes an approach to the *Basilosaurus* type.

* Proc. Acad. 1867, 155.

IXACANTHUS Cope.

This genus is similar to the next in the cylindric spinous character of the diapophyses of the caudal and lumbosacral vertebræ, but differs from it and all other Delphinidæ with which I am acquainted in the manner of attachment of the epiphyses of the vertebræ. Instead of being nearly plane and thin discs, they are furnished with two oblique faces above, which are capped by a projecting roof formed by the floor of the neural canal, while their central portion forms a knob which fits a corresponding shallow pit of the centrum.

IXACANTHUS CÆLOSPONDYLUS Cope.

Extremities of centra deeply concave when epiphyses are removed; length of vertebræ less than breadth.

| | In. | Lin. |
|--|-----|------|
| Length centrum lumbar..... | 2 | 4.5 |
| Width " "..... | 2 | 6.5 |
| Elevation " "..... | 2 | 4 |
| Width neural canal on dorsal..... | 1 | |
| " " " on lumbar..... | | 4½ |
| Length of caudal vert..... | 2 | 6 |
| Transverse diameter..... | 2 | 3 |
| Width diapophysis at base..... | | 6 |
| Lumbar,—elevation of body and spine to anterior zygapophysis | 4 | 9½ |

We have of this species three dorsals, nine lumbo-sacrals and one caudal, one only of the lumbo-sacrals exhibits the spine-like diapophysis characteristic of the genus. One of the caudals belongs to an entirely adult animal. The dorsals are rather constricted, and rounded below; the lumbo-sacrals have a strong median keel, except in one near the canal series, when it again becomes rounded below.

I first received this species from my kind friend Oliver Norris Bryan, of Charles county, Md. Jas. T. Thoms has also discovered various portions of it.

PRISCODELPHINUS Leidy.

Posterior lumbar and caudals spinous, dorsals with flat diapophyses.

The prominent character of the genus is seen in the lumbo-sacral and caudal vertebræ, whose diapophyses are very narrow at the base, and soon become cylindrical and slender, terminating in an obtuse point. The general form of the vertebræ is like those of Delphinus, but with the exception above noted, that the caudal vertebræ, instead of being shorter than the dorsals, are really longer, till we approach the posterior portions of the series. The largest of the typical species will not exceed seven feet in length, while the aberrant *P. flagellator* has been perhaps twelve.

In the *P. spinosus* Cope, the spinous form of the diapophyses is exhibited among the longer ones of the lumbar series considerably in advance of the caudals. In *P. a tropius* Cope, and *P. conradi* Leidy, I have seen it on the most posterior lumbar only, though it may occur further anteriorly, and several such have the diapophyses much narrowed. I have not seen it in the *P. harlani* Leidy, but it probably exists there, as the species is very near the *P. conradi*.

PRISCODELPHINUS SPINOSUS Cope.

This species is represented by two cervical, three dorsal and eight lumbo-sacral vertebræ; they are about as broad as long, with articular faces transversely oval. As they belong to more than one individual they vary a little more than is to be expected in a single series. They differ of course greatly in the size of the neural canal, with the position in the column. That with the smallest, (the posterior) exhibits no zygapophyses or their rudiments. General form depressed; sides of centrum nearly plane to a well-marked obtuse median keel.

1868.]

| | In. | Lin. |
|----------------------------|---------------|------|
| Length centrum lumbar..... | 1 | 9 |
| Width articular face..... | 1 | 7.5 |
| Height..... | 1 | 6 |
| Length diapophysis..... | 2 | |
| Width neural canal..... | } posterior { | 3 |
| Whole height of..... | | 8 |
| Length diapophysis of..... | | 6.5 |

This is the type of genus, for in it the peculiar form of the diapophyses extends much further forward on the series of vertebræ than in any other.

PRISCODELPHINUS ATROPIUS Cope.

This species is based upon three cervicals, and three dorsals of one, two lumbar and one caudal of a second individual, one lumbar and one caudal of another, and three lumbar of a fourth. The diapophysis of the caudal is short and spine-like, as in the last genus, and the last lumbar has had a nearly similar process. The centra of all are very slightly depressed and constricted medially. The dorsals are broadly rounded in section without inferior carina; on the last lumbar the lateral face below becomes, as in other species, slightly concave.

This species differs from the *P. harlani* in that the dorsal vertebræ are not so depressed, are stouter, and have not the median inferior keel seen in it.

| | In. | Lin. |
|----------------------------------|-----|------|
| Length of a dorsal (No. 1)..... | 2 | 2 |
| Width articular face | 1 | 11.5 |
| Depth " " | 1 | 7 |
| Height neural canal (No. 2)..... | | 9.7 |
| Length diapophysis (No. 1)..... | 1 | 4 |

PRISCODELPHINUS HARLANI Leidy.

Proceed. Acad. 1851, 327.

A few vertebræ of this species occur in the collection.

PRISCODELPHINUS CONRADI Cope.

Delphinus conradi Leidy, Proc. Academy, 1853, 35, Cope, l. c. 1867, 144.

This appears to be an abundant species of our Miocene beds. We have ten lumbar and one caudal vertebræ. Its affinities are apparently nearer the last-mentioned species than any other.

PRISCODELPHINUS STENUS Cope.

This species is represented by two vertebræ, but quite characteristic ones of the lumbar series. They indicate both the smallest and the most slender species of the genus. A section of the vertebra would have an almost exact pentagonal form, though the articular surfaces are subround, and, what occurs in no other species, a little deeper than wide. The neural arch preserved is elevated and possesses a weak pair of zygapophyses. The bases of the broken diapophyses indicate that they are very wide. The lower face of the centrum has a strong median longitudinal angle, stronger than in any species, and not prolonged into a thin keel as in *D. hawkinsii*. The planes of the centrum are mostly straight.

| | In. | Lin. |
|--------------------------|-----|------|
| Length centrum..... | 1 | 7.2 |
| Height..... | 1 | 0.5 |
| Width | 1 | 0.5 |
| " neural canal..... | | 5.8 |
| " basis diapophysis..... | | 10 |
| Height neural canal..... | | 6 |
| " zygapophysis..... | | 8.2 |

[July,

ZARHACHIS Cope.

This genus is established on vertebræ which bear a general resemblance to those of *Priscodelphinus*, but differ in the essential point of having flat and broad diapophyses of the caudals. It is therefore intermediate between that genus and *Delphinapterus*. The posterior of the caudals in our museum exhibits a narrowing of the diapophyses, as certain of the lumbar do in *Priscodelphinus*.

ZARHACHIS FLAGELLATOR Cope.

This species is represented by only two lumbar and two caudal vertebræ, which belonged to at least three different individuals, none of them adult. Neither is any one entirely perfect, but they indicate a very distinct species, by clear characteristics. All these vertebræ are of greater length as compared to the diameter than in any other cetacean known by me except the great *Basilosaurus*. The lumbar, when compared with those of *T. lacertosus*, differ in their broadly obtuse median line, which offers distinct trace of the two keels. An anterior caudal either exhibits unusually broad diapophyses, which are directed downwards, or else is a lumbar with two keels, and a median groove below, which is not seen in any other species. The caudals exceed in length those of any other species. One of these, from a large individual, resembles that of *P. a t r o p i u s* in the narrow basis of the diapophysis, which is probably narrow, and not perforate. The length of the vertebræ is nearly double the vertical depth of the articular faces. The diapophysis is nearly median; the basis of each neurapophysis is one-half the length of the centrum, and median.

| | In. | Lin. |
|---|-----|------|
| Length lumbar (epiphyses hypothetical)..... | 3 | 6.5 |
| Depth..... | 2 | 2 |
| Width..... | 2 | 3 |
| " neural canal..... | 2 | 8 |
| Length caudal (one epiphysis supplied)..... | 3 | 10.5 |
| Depth..... | 2 | 4 |
| Distance between inferior keels..... | | 10.5 |
| Width basis diapophysis..... | | 10.5 |

DELPHINAPTERUS Less.

DELPHINAPTERUS RUSCHENBERGERI Cope.

This species is represented by two vertebræ, a lumbar and a caudal, which indicate an animal of about the same or a little larger size than the *Priscodelphinus stenus*. They are also of a slender form, more so than in any species of the last genus. What distinguishes it generically, is that instead of the slender diapophyses of the caudal it has the broad ones of the true Dolphins, though broader even than is usual in these, and it is perforated a little on one side of the middle by the foramen seen among Whales and Dolphins generally.

Articular faces transverse oval; centrum slightly constricted with an obtuse keel along the median line. The two inferior keels of the caudal vanish on part of the middle of the centrum.

| | In. | Lin. |
|---------------------------------|-----|------|
| Length centrum..... | 1 | 9 |
| Height..... | | 10.3 |
| Width..... | | 12.5 |
| " neural canal..... | | 5.2 |
| " basis diapophysis lumbar..... | | 10.5 |
| " " " caudal..... | | 10. |

A dorsal vertebra which relates in age and size with the preceding, is more than usually constricted lateromedially, the inferior line concave, and slightly keeled; length $16\frac{1}{2}$ l., width 12.5 l.

1868.]

This species is dedicated to W. S. W. Ruschenberger, M. D., of this city, an active member of the Academy, and author of introductory works on Natural History.

DELPHINAPTERUS LACERTOSUS Cope.

This is much the largest species of the genus. It is based on two lumbar vertebrae which have been united by an exostosis and then separated. They are quite elongate and have broad diapophyses so far as their bases indicate. The articular surfaces are about as broad as deep, and slightly pentagonal in outline, not ovoid or discoid as in other species. The lower surface presents an obtuse median angle, with slightly concave sides. The general proportions can be derived from the measurements.

| | In. | Lin. |
|-------------------------------|-----|------|
| Length centrum..... | 3 | 5.5 |
| Height articular surface..... | 2 | 2.5 |
| Width " "..... | 2 | 4.5 |
| " neural canal..... | | 7.5 |
| " base diapophysis..... | 1 | 9 |

In addition to the above, there are in the Museum of the Academy specimens of dorsal lumbar and caudal vertebrae of this species from the Miocene of Cumberland county, New Jersey. They all belong to one individual and represent the characters of the species well. The lumbar are all strongly keeled below, and the dorsals narrowly rounded, and slightly concave on each side. One posterior caudal, with rudimental anterior zygapophyses exhibits rather short diapophyses pierced by the vertical foramen. I therefore refer this species to *Tretosphys* with the remark, that it is not so typical as the first mentioned species, where the perforation is at the middle of a broad, well developed transverse process.

The two species which follow are assigned to this genus, only on account of their resemblance to the present one, as I have not seen the caudal vertebrae of either. They may be thought to rest on but a slight basis—but as they are extremely easily distinguished among several bushels of bones of other species, I feel entire confidence in their reliability.

DELPHINAPTERUS TYRANNUS Cope.

This is a large species, doubtfully of the genus, not uncommon in the Miocene formations of Maryland. It is represented in the collection by one dorsal and three lumbar. Three of these serve as the type of our diagnosis. They are much shorter in relation to their other dimensions than those of any other fossil dolphin herein described, except the *Ixacanthi*, and they have the broad diapophyses of the genus *Delphinus*. The epiphyses are unfortunately lost, and but three of the specimens belong to the same individual. Articular surfaces broader than high, lateral faces concave everywhere and in every direction; below they meet in an obtuse concave ridge.

| | In. | Lin. |
|---|-----|------|
| Length centrum lumbar (epiphyses supplied)..... | 3 | |
| Depth "..... | 2 | 10.5 |
| Width "..... | 2 | 3.2 |
| " neural canal..... | | 6.7 |
| " basis diapophyses..... | 2 | 0.5 |
| Length lumbar of larger individual..... | | |

The rugosity of the epiphysial surfaces is less marked and more interrupted, *i. e.* without radiating ridges, than in any other species.

DELPHINAPTERUS HAWKINSII Cope.

This species is based on two lumbar vertebrae, which resemble those of *P. conradi*, (*Delphinus conradi* Leidy), but are of much larger size and are furnished with a strong and acute keel below on the median line, as is seen in no other species. The diapophyses are very wide at the base; centrum much

[July,

depressed. Both these specimens are young and have lost their epiphyses; with the latter, they would be relatively as slender as those of *D. lacertosus*; they differ from the latter in their deep keel, like that of a boat.

A dorsal vertebra is with much probability referred to the same species. It is therefore a little shorter than the lumbar and has not so strong a keel; yet the latter is more marked than in any other species, contrasting much with the round face of the *D. lacertosus*. It is adult with fixed epiphyses; the articular faces are subround. The upper part of the diapophyses come from the base of the neural arch, and the neural canal is wide, with median ridge as usual.

| | In. | Lin. |
|---|-----|------|
| Length, dorsal, centrum..... | 2 | 11.5 |
| Depth articular face..... | 2 | 0.5 |
| Width of " "..... | 2 | 2.5 |
| " " centrum at base transverse margin of diapophysis..... | 2 | 10.3 |
| Length centrum lumbar..... | 3 | 6 |
| Width in front diapophysis..... | 2 | 5.2 |
| " of "..... | 1 | 10.5 |
| Depth centrum from canal to edge of keel..... | 1 | 10.5 |

This species is named for my friend B. Waterhouse Hawkins, the restorer of the extinct mammals and reptiles at Sydenham Palace, England, who is now engaged in the Museum of the Academy on a similar work for the Central Park, New York.

DELPHINAPTERUS GABBII Cope.

This species is indicated by a well preserved caudal vertebra of an adult, which is so different from anything else in our Museum as to require notice. It has pertained to a species of not more than half the length of the *T. grandævus*, and is less strongly constricted everywhere and especially below. In a caudal of near the same position, the ridges and chevron articular surfaces are much more elevated, especially those on the anterior part of the centrum. They embrace a very deep groove in this, a shallow one in the *T. gabbii*. An additional longitudinal ridge on each side the inferiors in front is wanting in *T. gabbii*. Both have a delicate one above the diapophyses in front, the *T. grandævus* behind also. There is no posterior sygapophysis in the *T. gabbii*; the caudal of the latter is also relatively shorter.

| | In. | Lin. |
|------------------------------------|-----|------|
| Length centrum..... | 2 | |
| Depth articular face anterior..... | 1 | 5.7 |
| Width " " "..... | 1 | 7 |

This species is dedicated to my friend Wm. M. Gabb, Palæontologist of the State Geological Survey of California.

To this genus belongs also the *Priscodelphinus grandævus* of Leidy. This species is not rare in our collections.

I may add that there still remain species of *Delphinidæ* in the collection which are as yet undescribed.

BALÆNIDÆ.

The vertebræ of several rather small species of this family were procured by J. T. Thomas, of which a few are sufficiently characteristic for description. They are accompanied by the other bones of the body, but as these must be allocated with much care and labor, and as the vertebræ are most abundant and therefore characteristic of the beds, I think best to describe them from these.

ESCHRICHTIUS Gray.

ESCHRICHTIUS PUBILLUS Cope.

This species is indicated by many vertebræ, of which one dorsal, six of the 1868.]

lumbars, and one caudal may serve as types. They indicate a species of less size than any heretofore described, except perhaps the *B. rostrata* now living. They are about half the size of the vertebræ of *Balænoptera prisca* and *B. palæatlantica*, and 3-5ths those of *Eschrichtius cephalus*.

The dorsal is a little longer than transverse width of centrum, and 2-5ths longer than vertical width of the same; the latter is therefore a depressed oval. Inferior surface a regular arch from side to side. The lumbars have the usual median keel, and the articular faces are not quite so transverse; the external planes are generally concave. The venous foramina in these are so small as not to be noticeable.

The articular faces of the caudal are a little more compressed and nearly as deep as wide. The two inferior keels are very slight, the diapophysis are not perforate, and the neural arch stands on 3-5ths length of the centrum.

| | In. | Lin. |
|-------------------------------|-----|------|
| Length dorsal | 4 | 11 |
| Height articular face..... | 3 | 6.2 |
| Width " " | 4 | 3 |
| Width neural canal..... | 1 | 4 |
| Lumbar length..... | 4 | 11 |
| Height articular surface..... | 3 | 11 |
| Width " " | 4 | 2 |
| " neural canal..... | | 10 |
| Caudal, length..... | 4 | |
| Height articular surface..... | 3 | 9.5 |
| " to zygapophyses..... | 5 | 2 |
| Width articular surfaces..... | 4 | |

Several cervical vertebræ show the characters of the genus and species. They are all distinct, and their parapophyses and diapophyses have not probably been united, as the portions of them remaining are quite slender.

The superficial dense bony layer of the ramus of the mandible, of which we have specimens, is well developed, and nowhere fissured, and the nutritious foramina small. The ramus moderately convex on both faces, much as in the *Balænoptera prisca*, (*Balæna* Leidy), and like it, the nutritious foramina were arranged in a series on each side of and close to the median superior ridge. What distinguishes it from the latter is the presence of a distinct median ridge, which separated from the inner face of the ramus by a strong longitudinal groove. The nutritious foramina of the inner side penetrate along the line of this groove. The size is about one-third the same portion of the jaw of the *B. prisca*. Like the latter its inferior margin is greatly decurved, and the outer side more convex than the inner.

| | In. | Lin. |
|-------------------------|-----|------|
| Length of fragment..... | 15 | |
| Depth inner face..... | 2 | |
| Circumference | 5 | 2.5 |

Remains of the mandibles of this species are not uncommon in the Miocene region in the beds of streams. I have in similar situations dug out the vomers of two whales whose size would correspond with the present. Bullæ of the periotic bones of small *Balænidæ* are not uncommon in the same beds, and I suspect are mostly to be referred to this and the succeeding species.

The species appears to occur in the phosphatic deposit of the neighborhood of Charleston, South Carolina, as I have a specimen of a lumbosacral vertebræ from that locality. It was among the toothless whales what the small elephant of Malta was to the giant elephants. Our specimens have belonged to individuals of not more than fifteen feet in length, and probably adult.

[July,

MEGAPTERA Gray.

MEGAPTERA EXPANSA Cope.

This species is based on numerous vertebræ from the Thomas collection, several from the Nomini Cliffs, Westmoreland county, Virginia, presented to the Academy by my friend Oliver N. Bryan, of Charles county, Md., and by some in the Academy's Museum from Virginia.

The cervicals have a greater antero-posterior diameter than those of the *Eschrichtius* species, but show quite similar di- and parapophyses. They are, however, not at present in my possession, and their full description must be postponed for a time.

There are also ten dorsals and several lumbers and probably some cervicals from the same collection. The former have a broad and capacious neural canal, and the diapophysis is given off in all from the neural arch. In the lumbers this process is of course given off lower down, but in them it is flatter than usual. The centrum has somewhat the form of some of those of *Doryodon*, being broad and of little antero-posterior diameter. The articular faces have a transverse subcordate outline, being flat above. The basal face without keel. The form of the epiphyses indeed approaches sub-trigonal.

| | In. | Lin. |
|-----------------------------|-----|------|
| Length anterior dorsal..... | 2 | 9 |
| Height articular face..... | 2 | 8 |
| Width " "..... | 4 | |
| " neural canal..... | 1 | 9·7 |
| Length median dorsal..... | 3 | 2·5 |
| Height articular face..... | 3 | 0·5 |
| Width " "..... | 3 | 7 |
| " neural canal..... | | 14·5 |

The size of this species is quite comparable to that of the *Eschrichtius pusillus*, being one of the smaller species. The elevated position of its diapophyses distinguishes it from all the *Squalodons*.

The extinct species of *Balænidæ* of the United States are the following:

MEGAPTERA EXPANSA Cope.

ESCHRICHTIUS CEPHALUS Cope.

ESCHRICHTIUS LEFTOCENTRUS Cope.

ESCHRICHTIUS PUSILLUS Cope.

BALÆNOPTERA PRISCA Leidy.

BALÆNOPTERA PALÆATLANTICA Leidy.

There is no evidence that either of the two last named species are true *Balænopteri*. They may be *Eschrichtii*, but cannot at present be referred to those known as above.

It is to be observed that none of the Miocene species exhibit the dimensions possessed by the largest existing species, while several of them are smaller than the least of those of modern seas. The present period would appear, with present information, to be that in which these monsters have attained their greatest bulk.

The recent *Balænidæ* of our coasts are the following:

BALÆNA MYSTICETUS Linn., Polar Sea.

BALÆNA CISARCTICA Cope, Temperate Sea.

BALÆNA CULLAMACH Cham., North Pacific.

AGAPHELUS GLAUCUS Cope, Temper. Pacific.

AGAPHELUS GIBBOSUS Erl., Temp. Atlantic.

MEGAPTERA OSPHYIA Cope, " "

MEGAPTERA LONGIMANA Gray, Polar Seas.

ESCHRICHTIUS ? ROBUSTUS Lillj., Temp. Atlantic.

BALÆNOPTERA ROSTRATA Fab., North Atlantic.

SIBBALDIUS LATICEPS Gray, North Atlantic.

1868.]

The following notes on these species may be in place here.

Of the *Balæna cisarctica* there is a skeleton in the Museum of the Academy of an individual of thirty-seven feet, and a ramus mandibuli of sixteen feet in length, indicating a total of sixty-eight feet adult size. A scapula in the Museum Rutger's College, New Brunswick, N. J., measures 36 inches in height, and 48.5 in. in width, indicating an adult of 57 feet in length. A young individual of 45 feet line measurement, awaits mounting in the Museum Compar. Zoology, Cambridge, Mass. Of this individual I will shortly give a detailed description in an essay on the species. Like the other specimens, it presents a strong acromion. The phalanges of the manus exhibited an important difference from those of *B. australis*. In it they number respectively 2—5—6—3—3, while Cuvier gives (Oss. Foss. 227, 23) 2—5—6—5—4.

The species of *Agaphelus* are briefly noticed in the present number of the Academy's proceedings. They will be more fully described shortly from material at present in hand.

A second and more full examination of the skeleton of the *Megaptera osphya* Cope, furnishes the following additional points and characters. The specimen is young, and measures in its present condition, 34 feet. It has, however, lost a considerable number of caudal vertebrae, and from the posterior part of the column, of intervertebral cartilages also; add to this the shrinking of the cartilages preserved, and the increase of length would perhaps amount to eight feet, giving 42 in all. The asserted length of fifty feet line measurement, which I quoted in my original description, is no doubt an exaggeration.

The glenoid process is margined by an angular prominence, the rudiment of the coracoid, precisely as in the *M. brasiliensis*. The diapophysis of the atlas is a flat vertical plate, extending from opposite the base of the *foramen dentati* to opposite the widest point of the spinal canal; inferior posterior outline of the atlas broad, slightly concave medially. The mandible is peculiar in the strong angular process, which extends from behind round the side, projecting as far as the condyle, and separated from it by a deep groove. The third and fourth cervicals are united by the neural arch. The first rib is very broad at the extremity; length 37 inches, width at end, 8.22 in. The orbital processes of the frontal bone are not contracted at the extremities as in *M. longimana*, but are more as in *Balænoptera*; entire width over and within edge of orbit, 15½ in.; length to vertical plate of maxillary 31 in. The baleen measures two feet in length, is black, with three rows of coarse bristles. Its base is one curve; its length is spirally twisted.

The species is probably one of the largest of the *Balænidæ*.

The *Eschrichtius robustus* is admitted on the evidence of a ramus of the under jaw in the Museum Rutger's College, which is of peculiar form, and closely resembles the figure given by Lilljeborg of that portion of this rare species.

August 4th.

The President, DR. HAYS, in the Chair.

Eighteen members present.

August 11th.

MR. CASSIN, Vice-President, in the Chair.

Twenty members present.

[August,

On favorable report of the committees, the following papers were ordered to be published:

Notice of some remains of HORSES

BY JOSEPH LEIDY, M. D.

Mr. W. Lorenz loaned me for examination a horse tooth, black in color, and devoid of its outer cementum, from diluvium, occupying a depression about six feet in depth and about twenty feet in breadth, in the Silurian slate, between Rutherford's Station and Highspire, Lebanon Co., Pa. It is stained in texture with iron, mutilated at its lower part, and not petrified. It is a fifth upper molar of an individual which had just attained maturity, and does not differ characteristically from the corresponding tooth of the recent horse at the same age. The inflection of enamel at the bottom of the principal internal valley of the triturating surface is minute, but this is the case occasionally in the corresponding tooth in the living horse. The size of the tooth also is about that of the ordinary full-sized horse. The measurements, in comparison with a fifth molar contained in a recent horse skull, are as follows:

| | Fossil. | Recent. |
|---------------------------|-----------|-----------|
| Length..... | 40 lines. | 34 lines. |
| Breadth fore and aft..... | 15½ " | 15 " |
| Width, transversely..... | 12 " | 12 " |

The tooth may be viewed as having belonged to an indigenous horse, a contemporary of the Mastodon, but it is equally improbable.

Prof. Whitney has recently submitted to my inspection a fossil horse tooth from Martinez, Contra Costa Co., California, the largest I have ever seen or can recollect of being on record. The formation from which it was derived Prof. Whitney considers to be of pliocene age. The tooth is well preserved, retaining its outer cementum, and is but slightly, if at all, changed in texture. The tooth is a second upper molar, nearly half-worn. The triturating surface in its arrangement of the enamel presents nothing strikingly different from that of the corresponding tooth of the recent horse. As in this there is an inflection of the enamel at the bottom of the principal internal valley, and in this respect and the less simplicity of folding of the enamel islets of the triturating surface, differs from *Equus excelsus* of the Niobrara and of California. The tooth probably represents an extinct species, upwards of eighteen hands high. Its measurements are as follows:

| | |
|---|------------|
| Length along the outer median column to the origin of the fangs.... | 26½ lines. |
| Breadth of triturating surface fore and aft..... | 16½ " |
| Thickness independent of cementum | 15 " |
| " with cementum..... | 16 " |

The species represented by the tooth may be distinguished by the name of *EQUUS PACIFICUS*. I had previously seen fragments of an upper molar and two lower molars, apparently of the same species, from the same locality, submitted to my inspection by Prof. Whitney several years ago.

Coincidentally, Dr. Le Conte has just handed to me a bone indicating the smallest species of horse of which I have any knowledge. The bone, a second ungual phalanx or coronary bone, together with the proximal end of a metacarpal of a ruminant, were obtained by John C. Browne from a well 60 feet deep, at Antelope, Nebraska, 450 miles west of Omaha. The coronary bone in its axis is 9 lines long; the same width at the proximal end, and rather more than a line less at the distal end. From its relation of size with that of the recent horse, the animal to which it belonged was about eight hands high. It is uncertain to what solipedal genus the bone actually belongs, but in the absence of more characteristic materials, it may be viewed as representing a species of *Equus*.

1868.]

Notice of some extinct CETACEANS.

BY JOSEPH LEIDY, M. D.

HOPLOCETUS OBEUS.

Prof. F. S. Holmes, of Charleston, S. C., has recently submitted to my inspection a remarkable tooth and the fragment of another, which I recognize as having belonged to an extinct genus of Cetaceans, characterized under the name of *Hoplocetus* by Gervais, from similar teeth derived from the miocene and pliocene formations of France. The tooth, indeed, bears a near resemblance to that of *H. crassidens*, represented in figure 10, plate xx, of Gervais' Paléontologie Française, both in form and size, but is more curved, in this respect resembling more the tooth of that represented in fig. 11 of the same plate. Prof. Holmes' specimens were obtained from the post pliocene formation of Ashley River, in the vicinity of Charleston, S. C.

The more complete tooth has the end of the fang and a good portion of the crown broken away. The latter was worn away, leaving on the summit a broad, flat, discoidal surface. The enamel, where it remains, forms a band encircling about one-third of the crown, about three lines in depth, and one-fourth of a line thick. It appears to have been rugose longitudinally. The fang, a striking character in the teeth referred to *Hoplocetus*, is fusiform, remarkably robust, and large in proportion to the crown. It is straight at the bottom two-thirds, but curved towards the crown, so that this appears to be obliquely implanted upon it. The interior of the fang is pervaded by a narrow pulp cavity of irregular diameter, from the existence at its sides of nodosities. The part constituting the technical neck of the tooth is feebly constricted. The measurements of the specimen are as follows:

| | |
|---|-----------|
| Length in present condition in a straight line..... | 44 lines. |
| Estimated length of fang restored..... | 52 " |
| Greater diameter of fang | 19 " |
| Lesser " " | 16½ " |
| Estimated diameter of crown at base..... | 8 " |

The fang of this tooth appears to consist of an axis of dentine about equal in diameter to the crown, and its great accession of bulk appears to be due to the cemental layer.

The second specimen consists of the fragment of a tooth devoid of crown. The tooth has been of little greater bulk than the preceding, as the diameter of the remaining portion of the fang is 20½ lines.

Almost immediately after the reception of the above specimens, quite unexpectedly and purely coincidentally, I received, among some other cetaceous remains, another tooth, referable to *Hoplocetus*, from my friend, Prof. Wyman of Cambridge. This specimen was derived from the miocene formation in the vicinity of Richmond, Va. The tooth is much larger and straighter throughout than the better preserved of the two preceding specimens, and may perhaps belong to a different species,—a conjecture which is favored in the fact that the tooth was also derived from a different geological formation.

The crown is worn off in a blunt manner or somewhat convex disk, about 9 lines in diameter, and is encircled by a more or less worn and broken band of longitudinally rugose enamel, varying in depth from three to five lines, and one-third of a line in thickness. The fang is broken at its end, and exhibits a long conical pulp cavity, large enough to introduce the end of the middle finger for an inch or more. The fang in shape is fusiform, exceedingly robust, straight, and somewhat quadrate. As in the other specimens, it is composed of a dentinal axis near the diameter of the crown, enveloped in a huge accumulation of cementum. The length of the specimen in a straight line, in its present condition, is 55 lines. The fang in a restored

[August,

condition is estimated to have been 5 inches long. The diameter of the fang is 20 and $21\frac{1}{2}$ lines.

In the large proportion of cementum to the dentinal axis of the teeth of *Hoplocetus* they bear such a resemblance to the fragments found in the Red Crag of England, and referred by Prof. Owen to a genus under the name of *Balenodon*, as to render it probable the former is the same as the latter.

The relations of *Hoplocetus* or *Balenodon*, other than that they were toothed cetaceans, are unknown.

DELPHINUS OCCIDUUS.

An extinct species is indicated by a fossil derived from the upper miocene formation of Half-moon Bay, California, submitted to my examination by Prof. J. D. Whitney. The specimen consists of an intermediate portion of the upper jaw, devoid of teeth, and encrusted with selenite. It measures along the more perfect lateral border 5 inches, and in this extent is occupied with 19 closely set, circular alveoli, rather over 2 lines in diameter. At the back of the fragment the jaw has measured a little more than 2 inches wide. From this position it gradually tapers for half its length, and then proceeds with parallel sides to the fore end, where it is $10\frac{1}{2}$ lines wide. The palate behind is nearly plane or slightly convex; at its fore part it presents a deep median groove, closed by the apposition of the maxillaries, and this groove is separated only by a narrow ridge from the alveoli. The sides of the maxillaries are slightly concave longitudinally, convex transversely. The intermaxillaries are broken away, leaving a wide, angular gutter between the remains of the maxillaries.

Remarks on a jaw fragment of MEGALOSAURUS.

BY JOSEPH LEIDY, M. D.

A fossil worthy of notice in the Museum of the Academy consists of the fragment of a jaw, apparently of the Megalosaurus, which, if it does not belong to a different species from *M. Bucklandi*, indicates an individual larger than any one of those referred to by Buckland, Cuvier, Owen, etc. The fossil was purchased in England, and was presented to the Academy by Dr. Thomas B. Wilson. It is labelled, "Fragment d'une machoire de Megalosaurus trouvé dans le lias à Boué (or Boues). L'animal est extrêmement rare ici. Il avait 45 pied de longueur." In another hand it is marked "Jura Mts."

The fragment contains two mutilated teeth, visible throughout their length from the inner part of the jaw being broken away. The matrix adhering to the fossil consists of an oolite composed of a homogeneous clay-colored basis, with imbedded granules, of a rounded form, brown and shining.

The teeth are inserted into the jaw about two-thirds their length, and more than three-fourths the depth of the bone. They have measured $5\frac{1}{2}$ and 6 inches in length. The breadth at the base of the enamelled crown of the best preserved tooth is $14\frac{1}{2}$ lines, which is nearly the fourth of an inch greater than in the largest tooth represented in any of Prof. Owen's figures in his Monograph of the Fossil Reptiles of the Wealden Formation. A tooth apparently nearly as large in an American ally, is one referred to *Dinodon horridus*, and represented in fig. 21, pl. 9, of my memoir on the Extinct Vertebrata of the Judith River, published in the eleventh volume of the Transactions of the American Philosophical Society. The reconstructed outline of this figure is, however, too large, rendered so by the too distant removal of the apex of the tooth from the other fragment. The breadth of this specimen really did not exceed an inch.

The longest tooth of the fossil under inspection, for the most part broken away, exhibits a mould of the large interior pulp cavity. This mould, from the bottom of the latter to its broken end in the position of the crown, is $5\frac{1}{2}$ 1868.]

inches long. The broken end is 8 lines wide and $1\frac{1}{2}$ lines thick; the widest and thickest part of the mould near the middle of the length of the tooth is $11\frac{1}{2}$ lines wide and 5 lines thick.

The fangs of the teeth do not continue of the same width to the bottom, as in the teeth of crocodiles, and, as I believe, is considered to be the case in *Megalosaurus*, but from about their middle they contract, or become narrower, as is ordinarily the case in mammals. Indeed, one of these teeth isolated might be taken for the canine of a *Drepanodon*, or sabre-toothed tiger. In the fossil the bottoms of the fangs narrow antero-posteriorly, and become thinner from without inwardly, and they also curve somewhat in the latter direction.

The long fangs of the teeth in the fossil, and their becoming narrowed at bottom, at first led me to suspect the specimen belonged to a different genus from *Megalosaurus*, but a view of fig. 1, plate xii, of Prof. Owen's monograph above mentioned, seems to prove by the appearance of the successional teeth within the jaw, that the fangs actually become narrowed towards the bottom in that genus.

In the best preserved tooth of the fossil, the enamelled crown exhibits the same shape, familiar as the characteristic form of that of *Megalosaurus*. The trenchant borders of the crown are denticulate, and the enamel is comparatively smooth, or only very feebly striate.

The contracted condition of the bottom of the fangs of the teeth would leave more space than there otherwise would be for the development of successional teeth within the jaw. In the fossil the remains of one of the latter is seen at the lower part internally of one of the functional teeth, and an impression in a corresponding position of the other functional tooth indicates a similar occupant.

In the progress of the successional teeth of *Megalosaurus*, their summit first appeared at the margin of the jaw internally to the teeth in functional position. In the course of growth and protrusion they excited absorption in the contiguous bone and fang of their predecessors, and continuing to advance from within and beneath (in the lower jaw), as it were, shouldered the latter from the jaw. A third tooth in *Megalosaurus* appears to have occupied a position internal to the second one, before the protrusion of this from the jaw.

The outer portion of the jaw bone retained in the specimen has an average depth from the alveolar border of 5 inches. Its outer surface is a vertical plane, rounding only near the base.

The present opportunity is an appropriate one to make a few remarks on the American allies of *Megalosaurus*. Since I have had the opportunity of inspecting the remains of the remarkable reptile from the green sand of New Jersey, described by Prof. Cope (Proc. 1866, 275) under the name of *Laelaps aquilunguis*, in observing the comparative uniformity of the teeth, identical in character with those of *Megalosaurus*, I am more strongly impressed with the idea that the teeth of like shape forming part of those referred by me to *Dinodon*, alone belong to this genus. The others, of which no representatives have been discovered or recognized as belonging to *Megalosaurus* or *Laelaps*, most probably indicate a distinct genus and species, for which I propose the name of *Aublysodon mirandus*.

Future discovery may prove *Laelaps* and *Dinodon* identical, and, judging from the comparison of corresponding parts of the jaws and the teeth, will be found to be more closely allied to *Megalosaurus* than was suspected, even should they not prove to be generically the same.

It is clear, from an examination of the anterior portion of the mandible of *Megalosaurus* described and figured by Buckland, Cuvier, Owen, etc., that no such teeth as those now referred to *Aublysodon* occupied the forepart of the jaw. It is also probable that the upper teeth of *Megalosaurus* and of its

[August,

allies differ in no important point from those below. It follows, therefore, that the teeth now referred to *Aublysodon*, if they belong to the maxillary or mandibular series of *Megalosaurus* or its allies, could only pertain to the back part. The variation in form of the teeth in question appears too great for such a position.

The teeth now viewed as characteristic of *Aublysodon* are represented in figs. 36—45, pl. ix of vol. xi of the Transactions of the American Philosophical Society. The specimens consist of parts of three teeth, which differ much in size and other important points. In general the crowns are laterally compressed conical, with the anterior part thick and convex transversely as well as longitudinally, and with the sides nearly parallel. The posterior part forms a surface nearly as wide as the thickness of any part of the crown, and is defined from the lateral surfaces at right angles. In the two larger teeth these angles or borders are denticulated, like the trenchant borders of the teeth of *Megalosaurus* and its American allies. In the longest tooth (fig. 35, 36, op. cit.) the posterior surface forms an even plane; in the second sized tooth (figs. 37—40) the posterior surface presents a median elevation. In the smallest tooth (figs. 41—45), which indeed may belong to a different animal from the preceding, the borders defining the posterior surface are somewhat prominent backward, non-denticulate, and subside approaching the base of the crown so as to make a transverse section in this position oval (fig. 45).

Hadrosaurus Foulkii, the bulky vegetable feeder, and cotemporary of the rapacious *Laelaps aquilunguis*, was at most probably only specifically distinct from *Trachodon mirabilis*, the teeth of which were found in association with those of *Dinodon*, so that, according to the laws of nomenclature, as *Trachodon* has priority of name, I suppose the first mentioned animal must be called *Trachodon Foulkii*, though the names of *Hadrosaurus Foulkii* and *H. mirabilis* would appear more appropriate for these powerful dinosaurs.

The best preserved tooth of those originally referred to *Trachodon*, represented in figs. 1—6 of the plate above cited, is identical in form with those referred to *Hadrosaurus*, and differs only in the absence of the rugulations of the lateral borders of the crown, and in some less important points.

The remaining specimens of teeth referred with the former to *Trachodon*, are represented in figs. 7—20 of the plate cited. Most of them are so worn and probably altered from their original form, that it is rendered uncertain whether they belong to the same animal as the preceding tooth, and one unworn (figs. 18—20) has a very different shape from this. Perhaps these specimens belonged to another Dinosaur, for which the name *Trachodon* might be reserved, while that of *Hadrosaurus* might include the first mentioned and more characteristic tooth.

As *Iguanodon* had its enemy in a species of *Megalosaurus*, *Trachodon*, the representative of the former both in the western and eastern portions of the North American continent, was accompanied by an equally bloodthirsty enemy, which may, perhaps, on nearer comparison of corresponding parts, prove to be another species of the same genus, until now supposed to be different, under the names of *Dinodon* and *Laelaps*.

Prof. Cope remarks of *Laelaps* (Pr. A. N. S. 1866, 276), that "in its dentition and huge prehensile claws it resembled closely *Megalosaurus*, but the femur, resembling in its proximal regions more nearly the *Iguanodon*, indicated the probable existence of other equally important differences, and its pertinence to another genus." Thus the genus is especially distinguished by the apparent peculiarity of the femur, but in my estimation even this disappears if the bone referred to *Laelaps* be viewed in the corresponding position to that of *M. Bucklandi*, represented in pl. vii, pt. iii, of Prof. Owen's Monograph of the Fossil Reptiles of the Wealden, which appears to me to be the reversed one to that in which Prof. Cope has described it in Pr. A. N. S. 1866, 276.

The teeth of *Bathygnathus*, a huge carnivorous reptile, whose remains have
1868.]

been found in the triassic red sandstone of Prince Edward's Island, have the same form as those of *Megalosaurus*, *Dinodon* and *Laelaps*. But here, so far as we have the corresponding parts for comparison, the resemblance ceases. The remarkable depth of the dentary bone in relation with its length in *Bathynathus*, indicates a form of head very different from that of *Megalosaurus* and its American representatives. It was this unusual relation of depth to breadth which led me to suspect a form of head more in accordance with that of the skeleton of an upright animal, and led me to ask the question, "was this animal probably not one of the bipeds which made the so-called bird tracks of the New Red Sandstone of the valley of the Connecticut?" (See Jour. Ac. Nat. Sc. 1854, 329.)

Subsequently, in examining the remains of *Hadrosaurus*, the American representative of *Iguanodon*, from the great disproportion between the fore and hind parts of the body, I was led "to suspect that this great herbivorous lizard sustained itself in a semi-erect position on the huge hinder extremities and tail, while it browsed on plants growing upon the shores of the ocean." (Cret. Rept. of the U. S. 1865, 97.)

The remains referred to *Laelaps* exhibit even a far greater disproportion between the fore and hind limbs than in *Hadrosaurus*, which, together with its long bird-like claws, etc., suggested to Prof. Cope a similar position of body to that of *Hadrosaurus*, and a use of the hind limbs in attack upon the prey of the animal analogous with that in the eagle (Pr. A. N. S. 1866, 279). The extraordinary disproportion between the fore and hind limbs of *Laelaps*, which appears to me so closely related with *Megalosaurus*, leads me to suspect that the remains described by Buckland, Cuvier, Owen and others, and attributed to the shoulder of *M. Bucklandi*, perhaps, at least in part, belong to the pelvis, if they in whole or part do not belong to other animals. Had the humerus of *Laelaps* been found isolated, I never would have thought of associating it in the same skeleton with the huge bones of the hinder extremity of that animal. Perhaps, when this great disproportion comes to be known, it may be discovered that there exist specimens of remains of the fore limbs of *Megalosaurus*, from the Wealden, in the British or other museums of England, which heretofore have excited no suspicion as to their true relations.

Terratosaurus, from the upper Keuper, in the vicinity of Stuttgart, described by Meyer (Palæontographica, 1859-61, 258), approached *Bathynathus* most in the proportions of its face, as well as resembled it in the form of the teeth, but the fossil dentary bone of the latter is even still shorter and deeper than would relate to the fossil maxillary of the former.

Remarks on *CONOSAURUS* of Gibbs.

BY JOSEPH LEIDY, M. D.

In a memoir on *Mosasaurus* and the allied genera, by Dr. R. W. Gibbs, published in the second volume of the Smithsonian Contributions to Knowledge, the author described some teeth from the eocene formation of Ashley River, South Carolina, which, from their general resemblance with those of *Mosasaurus*, both in form and conjunction with osseous bases, he referred to a reptile with the name of *Conosaurus Bournani*.

An examination of the structure of these teeth proved to me that they belonged to a fish. The body of the crown is composed of a compact vasodentine, invested, in place of enamel, with a thin layer of ordinary dentine. There is no pulp cavity in the interior; and in the complete teeth, the crown is continuous with a robust osseous fung, resembling in general appearance that of the teeth of *Mosasaurus*.

A short time since Prof. F. S. Holmes submitted to my examination the dentary bone of *Conosaurus*, imbedded in a block of white eocene marl, from

[August,

the vicinity of Charleston, South Carolina. The specimen fully confirms the view that the animal is a fish.

The dentary bone, from its symphysis to where it articulated with the angular bone, judging partly from the bone itself and the impression of the remainder on the matrix, has been a little over six inches in length. Its depth at the symphysis has been about two and a quarter inches.

Twelve teeth have occupied the alveolar border in a space of four inches and ten lines, and perhaps a couple more occupied the part broken away behind. The teeth form an unbroken row, close together, and generally differ but little in size, though those posteriorly are a little the smaller.

The perfect crown of the teeth forms a nearly regular cone, the fore and aft diameter of the base slightly exceeding the transverse. It is curved inwardly, pointed, smooth, shining, and even, except at the base, where it is slightly fluted, being most so in the anterior teeth, and more or less feebly so in the hinder ones.

The crown ceases at the alveolar margin, where it becomes continuous with a more robust, solid, oval fang, which is inserted into the jaw and coössified with its alveolus.

In the dentary bone above mentioned, the crown of the first tooth, or that nearest the symphysis, is broken off, displaying a clean continuous disk of vasodentine, nearly circular, and about four lines in diameter. The fang is visible from a destruction of a portion of the bone. It is half an inch long, of greater diameter than the base of the crown, and composed of bone hardly more dense than that of the jaw itself, with which it is coössified. The fourth tooth of the series is in the same condition as the former.

The crown of the second tooth had been shed, and its remaining solid fang is somewhat encroached upon, through absorption, by the fang of the tooth in front.

The third, eighth and twelfth teeth have been shed, and their fangs absorbed, leaving deep oval cavities. These were filled with matrix, and nothing more. It is probable they contained successional teeth, which dropped out in the decomposition of the animal.

The fifth tooth had been shed, and its remaining fang contains a funnel-shaped pit.

The sixth and tenth teeth alone remain in the specimen, the latter entire, the former without its point. The crown of the sixth was nearly eight lines long; the other is seven lines.

The crown of the seventh tooth has been broken off, and the fractured surface displays a small central cavity.

The crown of the ninth tooth, which was smaller than any of the others, is shed, leaving the fang somewhat excavated; but the sides are narrowed, as if the position of the tooth were to have been obliterated to give more room for the accommodation of others.

Back of the tenth tooth there is a small pit, probably the remains of the position of an early tooth smaller than that last indicated. This included would give thirteen to the series.

The crown of the eleventh tooth had been shed, leaving a shallow basin on the top of the fang.

I could find no successional teeth in the specimen. Those which existed appear to have dropped out of the exposed cavities.

From a study of the fragment it would appear as if the germs of new teeth originated in the centre of the preëxisting teeth,—that is, at the conjunction of the crown and fang. In the development of the new tooth it was first accommodated in its growth by the absorption of the fang of the old tooth. The crown of the latter being shed, that of the new one gradually assumed its position, and when protruded its fang became coössified with its alveolus.

A specimen in the museum of the Academy, from Ashley River, S. C., consisting of an isolated tooth with the greater portion of its fang, is larger than 1868.]

any of the teeth in the dentary bone above described. The crown is eight lines long and four and a quarter in diameter at base. The fore and back part of the robust osseous fang present concavities, as portions of cavities remaining after the shedding of teeth with absorption of their fangs.

Of two shed crowns in the museum, from the same locality, one is $5\frac{1}{2}$ lines long by $2\frac{1}{4}$ and $1\frac{1}{4}$ in diameter at base; the other $6\frac{1}{2}$ lines long by $3\frac{1}{4}$ and $3\frac{1}{4}$ at base.

The museum of the Academy also contains two specimens consisting of alveolar fragments of jaws with teeth, of the same animal, from Burlington Co., N. J. They were presented by W. J. Taylor, and are reputed to have been obtained from the green sand.

One of the specimens is $2\frac{1}{2}$ inches long, and contains an alternation of teeth and empty cavities for successional teeth. The first cavity is large, the fang formerly occupying its position being completely absorbed. The second tooth of the specimen is entire. Its crown is 7 lines long by 4 and $3\frac{1}{4}$ at base. The third and fifth cavities for successional teeth are not quite so large as the first, nor are the fangs which occupied them so completely absorbed. The fourth tooth has its crown mutilated. Its base behind is irregularly excavated, but whether by erosion, or whether it is the remains of a position occupied by a successional tooth, I cannot determine. In the sixth tooth the crown is not entirely protruded, and its fang is already coössified with a tubular sheath of the fang of the former tooth which occupied its position. In the seventh tooth the crown is shed, but the fang remains with a large cavity. The crown of the eighth tooth was also shed and the fang nearly obliterated through absorption.

The smaller alveolar fragment is $1\frac{1}{4}$ inches long, and contains two teeth, with an intervening cavity for a successional tooth. Before and behind the two teeth are the remains of other cavities.

Though I have an aversion to change names, yet the name *Conosaurus* is so obviously wrong and liable to mislead, especially also as there is a saurian named *Coniosaurus*, that I propose for the former the name of *CONOSAURON*.

I may here take occasion to mention that I have suspected that the tooth represented in figs. 7, 8, 9, pl. xx, of my "Cretaceous Reptiles of the United States," and referred to a carnivorous reptile with the name of *Tomodon*, may also have been a fish. The base of the specimen presents an irregular porous condition, but this I suspect rather to be the result of erosion. As it is unique, I have not been able to obtain a section to examine its microscopic structure. As the name *Tomodon* had been previously appropriated by Duméril for a genus of serpents, I would propose to alter the name applied to the animal to which the fossil belonged, to that of *DIPLODOMON*.

August 18th.

The President, DR. HAYS, in the Chair.

Sixteen members present.

August 25th.

The President, DR. HAYS, in the Chair.

Twenty-three members present.

Messrs. Uselma Smith and B. Waterhouse Hawkins were elected members.

Mr. Ralph Tate, of London, was elected a correspondent.

On favorable report of the Committee, the following paper was ordered to be printed:

[August,

On the Crocodilian genus *PEROSUCHUS*.

BY EDWARD D. COPE.

Characters.—Toes 5-4, with claws two—three. No osseous nasal septum or bony eyelid. Belly protected by series of osseous plates, as well as the back.

All the genera of Crocodiles hitherto known as living are characterized by the possession of three claws on the fore foot. The present therefore offers a remarkable exception. The free fingers and half webbed toes, and the bony abdominal buckler, together with the cartilaginous nasal septum are points of strong resemblance to *Jacare* (Gray, including *Cæman* Gray), but it differs from these creatures in the lack of bony orbital plate. In specific characters it differs from those of this genus, which it most resembles, as *J. nigræ*, in the absence of a transverse bony ridge between the orbits. Another feature of importance is the relation of the canine teeth of the lower jaw to the upper. On one side this tooth is received into a notch, as in Crocodiles, on the others it enters a pit of the maxillary bone, within the border of the same, as in Alligators! This remarkable combination may be abnormal even in this species, but this cannot be now ascertained, as it rests at the present time on a single specimen only. As its affinities are rather more alligatorial, I am disposed to anticipate that the dental arrangement of the latter type will be most common.

PEROSUCHUS FUSCUS Cope.

Char. specificus.—Nuchal plates in a cross row of six; cervicals in four cross-rows, all of four plates except the last of two. Dorsal plates six—in a few eight in each transverse row. No posterior crest on arm or leg. Tail short with remarkably low crest. Muzzle broad, flat, without any ridges; its width at the eighth tooth entering 1·4 in length from end of muzzle to anterior margin of orbit.

Description.—The specimen in the Museum of the Academy is young, measuring only 2 feet 5 inches in length. Of this the skull measures to the margin of the supra-occipital 2 in. 10·5 lin.; and the tail from the vent 13 in. 1 line. From groin to heel 3 in. 2·5 lines, and the hind foot 2 in. 7·5 lines. The muzzle is a broad ovate, the sides rather more convergent anteriorly than in the Alligator *mississippiensis*. There is a thickening in front of each orbit, and between them on the middle line another, which together enclose two shallow concavities. Superciliary margins raised, the cranial table quite flat. The margin of the quadrato-jugal bone projects strongly. The scales of the limbs are all smooth and those of the dorsal region with very low keels. The sides have four longitudinal rows of ovate scales separated by scarcely defined smaller ones. The abdominal plates are longer than broad, and are in twelve longitudinal rows. Dorsals in seventeen transverse series from interscapular to crural region. The lateral crests of the tail are only obtuse keels; they unite on the thirteenth annulus behind the vent inclusive. Color above dark brown, almost black on the upper surface of the head. The tail is paler, of a light olive brown. Lower surface everywhere bright yellow, including the entire lower jaw and margin of the upper. Eyelids and a band through ear yellow, the former with a black spot above.

Remarks.—This interesting addition to our knowledge of the Reptilia was made by Schulte Buckow, of New York, while on a visit to the interior part of the course of the Magdalena River, in New Grenada. This naturalist has also enriched our collections with other interesting vertebrata of that region, both living and dead.

1868.]

Sept. 1st.

The President, DR. HAYS, in the Chair.

Twenty-two members present.

Sept. 8th.

The President, DR. HAYS, in the Chair.

Twenty-eight members present.

Sept. 15th.

The President, DR. HAYS, in the Chair.

Twenty-eight members present.

The following papers were presented for publication :

Extinct Mammalia of Dakota and Nebraska, including an account of some allied forms from other localities, together with a synopsis of the Mammalian Remains of North America. Illustrated by twenty-eight plates. By Joseph Leidy, M. D. Preceded by an introduction on the Geology of the Tertiary Formations of Dakota and Nebraska, accompanied by a Map. By F. V. Hayden, M. D.

Notice of American Species of *Ptychodus*. By Joseph Leidy, M. D.

Synopsis of the Extinct Batrachia of North America. By Edw. D. Cope.

Dr. Leidy read a letter from Mr. B. Waterhouse Hawkins, proposing to erect in the Museum, at his own expense, the fossil remains of the *Hadrosaurus* to their natural relations in the figure of that great Dinosaur, in accordance with Dr. Leidy's descriptions in his Monograph of the Cretaceous Reptiles of the United States.

On leave being granted, the following resolutions, offered by Dr. J. L. LeConte, were adopted :

That the Academy accept the proposition of Mr. B. Waterhouse Hawkins, to erect in this Hall, at his own expense, a restoration of the skeleton *Hadrosaurus*.

That the thanks of the Academy be respectfully tendered to Mr. Hawkins for his liberal offer, and that the Curators be instructed to furnish to him every facility in the use of specimens in the Museum, which the most liberal interpretation of the By-Laws will permit.

Sept. 22d.

DR. BRIDGES, in the Chair.

Twenty-four members present.

Sept. 29th.

The President, DR. HAYS, in the Chair.

Twenty-four members present.

[Sept.

Dr. D. G. Brinton was elected a member.

On favorable report of the Committee, the paper of Dr. Leidy, presented Sept. 15th, entitled "Extinct Mammalia of Dakota and Nebraska," etc., reported in favor of its publication in the Journal.

On favorable report of the Committees, the following papers were ordered to be printed:

Notice of American Species of *PTYCHODUS*.

BY JOSEPH LEIDY, M. D.

The Cestraciont genus of fishes *Ptychodus*, so far as known, is confined to the Cretaceous Formations. Remains, consisting of teeth, I have had the opportunity of inspecting from Alabama, Mississippi and Kansas, and although reported to exist in the Cretaceous Formation of Delaware, I have not met with them from that locality nor from the Green Sand, of corresponding age, of New Jersey. The following list comprises all the specimens of American *Ptychodus* teeth I have had the opportunity of examining.

***PTYCHODUS MORTONI*.**

Agassiz, Poissons Fossiles III. (1833-43), 158, Tab. 25, figs. 1—3; copied in figs. 773, 773a, of Dana's Manual of Geology.

Palate bone of a fish? Morton: Syn. Org. Rem. Cret. Group. (1834), pl. xviii, figs. 1, 2.

The teeth of *Ptychodus Mortoni* I have seen only from the cretaceous formation of Alabama and Mississippi. Morton, in the work above noticed, figures a tooth, but does not mention the locality from which it was obtained.

Agassiz, in his Poissons Fossiles, gives a good representation of a tooth of this species, from the Green Sand of America, in three views, figs. 1—3, Tab. 25.

Dixon, in his Geology of Sussex, represents two small teeth, (figs. 6, 7, pl. xxi), which he refers to the same species. Though exhibiting some resemblance in character to the American teeth, I think a further comparison is necessary to establish their specific identity.

The teeth of *Ptychodus Mortoni* are well defined in character, and in comparison with teeth of well recognized European species are almost generic in their peculiarity. Though exhibiting some variety, their likeness presents a distinct specific uniformity. Their size of course varies greatly with age and the relative position they occupied with one another in the mouth of the fish.

Viewed from above, the crown is reniform in outline, the long diameter being transverse; the incurvature posterior. The crown rises in the form of a cone with a more or less obtuse summit. The sides of the crown slope to the base and frequently more or less abruptly expand, laterally approaching the latter. The back part is occupied by a wide triangular sinus for the reception of the fore-part of the crown of the tooth which was situated in front of it when the teeth were contained within the mouth. The border of the crown is thick and rounded and dips beneath. At the sinus it is prominent. The summit of the crown presents a prominent crucial ridge, more or less distinct in different specimens. From the cross numerous ridges of about the same thickness diverge upon the sides of the cone, branching in their course, multiplying and becoming finer, and ultimately conjoining upon the base in a fine reticulation extending to the borders of the crown. The coarser ridges vary in their proportionate length in different specimens. The reticulation of the base is most extensive laterally, occupying usually half the breadth of the space between the summit and border. It also occupies the sinus, and is least developed at the fore-part of the crown. The width of the crown approaches double the

1868.]

fore and aft measurement, and the height is usually little less than the latter. The root partakes of the form of the outline of the base of the crown, but is more square and is flat or transversely concave below.

Twelve specimens of teeth of *Ptychodus Mortoni*, from the Cretaceous Formation of Alabama, belonging to the Yale College Museum, have been submitted to my examination by Mr. William M. Gabb. Among them occurs the largest tooth of the species I have seen, and larger than any on record. It is labelled as having been derived from Perry Co., Alabama. The fang and parts of the lateral and back borders of the crown are broken away. In the perfect condition the crown has measured a little over two inches in transverse diameter, one inch and a quarter antero-posteriorly, and ten lines in height. The crushing surface is porportionately less prominent at the centre than in the smaller teeth attributed to the same species, and is more uniformly convex, or less expanded laterally at the base. The borders of the posterior sinus also are less abrupt or defined. The unworn summit presents a crucial ridge, of which the lateral radii are most distinct and directed postero-laterally. From the crucial ridge, numerous ridges, equally prominent, diverge, branch in their course and ultimately conjoin in a fine reticulation at the base of the crown. This reticulation has the greatest breadth at the sides of the crown and is least developed at the fore-part.

Eleven teeth from Uniontown, Alabama, exhibit a gradation in size from less than three-fourths that of the above described specimen down to one little more than a fourth of its diameter. The specimens present a remarkable similitude throughout. Some are proportionately wider fore and aft than others, and the smallest are porportionately higher than the largest ones. The outline of the base of the crown is reniform, with the relation of the longer and shorter diameters varying. The largest specimen has the crown an inch and a half wide, a little over three-fourths of an inch fore and aft, and about half an inch in height. The sides of the crown expand at the base laterally; the fore-part forms nearly a uniform slope, and the back surface slopes to the sinus, which forms a broad triangular depression. The fang is fourteen lines wide, seven lines fore and aft, and three lines in depth.

The crown of a median sized tooth of the series, unworn, measures scant 14 lines wide, $7\frac{1}{2}$ fore and aft, and $6\frac{1}{2}$ high. The smallest specimen has the crown 7 lines wide, $4\frac{1}{2}$ fore and aft, and an equal height. Its base laterally appears more abruptly expanded than in the others. Most of the specimens are unworn and exhibit the characteristic ridges of the crown in a striking manner. In three specimens the coarser ridges are resolved into the reticulation much earlier or nearer the summit than in the others. In one specimen the crown is smooth or totally devoid of ridges, presenting the same appearance represented in figs. 4, 5, pl. xxx, of Dixon's Geology of Sussex, and described as "nascent or incomplete teeth of *Ptychodus*."

Seven specimens of teeth in the Museum of the Academy, from Alabama, exhibit the same characters expressed in the description of those above. They all present an unmistakable specific likeness, though varying in the proportions of their diameter. The largest specimen has the crown 16 lines wide, 11 lines fore and aft, and 8 lines high. The root is an inch wide, 7 lines fore and aft and nearly 3 lines thick. A second specimen, with the crown 16 lines wide and 9 lines fore and aft, has been proportionately lower than the former. Its summit is worn away, leaving an exposed circular disk of vaso-dentine 4 lines in diameter.

Two specimens in the Museum of the Academy, presented by Prof. Joseph Jones, are from Green Co., Alabama. The larger is perfect and unworn. The crown is scant 14 lines wide, by 7 lines fore and aft, and 5 lines high. The root is $11\frac{1}{2}$ lines wide, $4\frac{1}{2}$ fore and aft, and 2 lines thick.

Two specimens in the Museum of the Academy, presented by Dr. Wm. Spillman, are from Columbus, Mississippi. They present the same character as the Alabama specimens. The larger specimen has the crown 20 lines wide, 10 lines

[Sept.

fore and aft, and has perhaps been about 8 lines high. The summit is worn off, leaving an exposed flat circular surface of vaso-dentine half an inch in diameter. The root is 15 lines wide, 6 lines fore and aft, and three lines thick. The smaller specimen consists of an unworn crown $11\frac{1}{2}$ lines wide, 7 lines fore and aft and $5\frac{1}{2}$ lines high.

PTYCHODUS OCCIDENTALIS, n. s.

The Museum of the Academy contains a specimen consisting of the crown of a tooth of a species of *Ptychodus* differing from any other previously known. It was obtained by Dr. John L. LeConte, in association with other remains of fishes, from an ash-colored rock of the Cretaceous series, a few miles east of Fort Hays, Kansas.

The tooth is remarkable, especially from the comparatively near approximation of its diameters, the width transversely and fore and aft and the height approaching one another more nearly than in any other species. The fore-part of the crown is somewhat injured and the root is broken away. The transverse diameter of the crown at base is 14 lines; the fore and aft diameter has been about an inch; and the height is also an inch.

In shape the crown is a blunt cone with the sides sloping evenly to the base and to the posterior sinus. The latter is a triangular concavity about two-thirds of the breadth in height.

The direction and arrangement of the ridges of the crown are much like as in the European *Ptychodus decurrens*, but the principal ridges crossing the crown transversely are finer and the intervals much narrower, indeed the space occupied by a pair of ridges with their interval in *P. decurrens* would accommodate three ridges with a pair of intervals in *P. occidentalis*. Descending the sides of the cone the ridges branch as in *P. Mortoni*, and at the basal half of the crown form a reticulation much as in *P. decurrens*. At the back of the summit of the crown the principal ridges continue their transverse or parallel course until near the upper part of the sinus, into which as they descend they are resolved into a fine reticulation. The fore-part of the crown is occupied by a reticulation formed by the descent, convergence and division of the more anterior principal ridges.

From the description it will be observed that the tooth holds an intermediate position in anatomical character to those of *Ptychodus Mortoni*, and *P. decurrens*.

Three small teeth, found by Dr. Le Conte in association with the latter, resemble, in their proportions and in the proportionate size and arrangement of the ridges of the crown, the teeth of *P. decurrens*, but perhaps may belong to the same species as the large tooth above described. The larger of the three specimens is perfect, but has the summit of its crown worn off. The crown measures 7 lines transversely, 6 lines fore and aft, and has been from 4 to 5 lines high. The root is 6 lines wide, $4\frac{1}{2}$ lines fore and aft, and $2\frac{1}{2}$ lines thick. Comparatively coarse ridges cross the crown transversely, curving forward laterally and ending in a marginal reticulation. Branching ridges descend in front from the foremost of the transverse ridges, and likewise end in a marginal reticulation. The sinus is occupied by a finer reticulation joined by fine ridges descending from the summit and sides of the crown. The smallest tooth, likewise perfect, has the crown $4\frac{1}{2}$ lines wide, $3\frac{1}{2}$ lines fore and aft, and $2\frac{1}{2}$ lines high.

Three additional specimens associated with the former ones, are the smallest teeth of *Ptychodus* I have seen, but I suspect that they belong to the same species. They are transversely ellipsoidal in outline at the base of the crown, and this appears as a low cone elevated at the inner third and with a broad expanding base. The sinus is situated at the inner posterior third. The surface of the crown is crossed with transverse ridges which form a narrow reticulation at the border. The largest of these small specimens is $3\frac{1}{2}$ lines transversely, $1\frac{1}{2}$ fore and aft, and $\frac{3}{4}$ of a line high from the root. The smallest tooth is $2\frac{1}{2}$ lines wide, $1\frac{1}{2}$ fore and aft, and $\frac{1}{2}$ a line from the root.

1868.]

PTYCHODUS POLYGYRUS.

Agassiz : Poissons Fossiles III, 156 ; Dixon : Geology of Sussex, 1850, 363. Gibbes : Jour. Acad. Nat. Sci., 1849, 299, pl. 42, figs. 5, 6.

Dr. Gibbes, in the work above noticed, figures two teeth, from the cretaceous formation of Alabama, which he refers to *Ptychodus polygyrus*. They clearly bear a close likeness to specimens of the European species of that name.

A single specimen of a tooth, accompanying the Alabama specimens belonging to the Yale College collection, resembles the teeth of the European *Ptychodus polygyrus*. The crown is nearly square or transversely oblong, with the fore and back borders nearly straight, and the lateral borders convex. The crushing surface is moderately convex and is crossed transversely by ten coarse acute ridges, separated by similar intervals. The borders of the surface, including the posterior sinus, are occupied by comparatively fine vermicular and interrupted ridges, appearing like granulations. The coarse ridges are nearly straight, and at the end rather abruptly resolve themselves into the finer vermicular ridges of the border. From European specimens of the teeth of *P. polygyrus* and *P. latissimus*, this tooth appears especially to differ in the proportionately greater degree of fineness of the bordering vermicular ridges or granulations of the crown. Its measurements are as follows :

Width of crown 13 lines ; fore and aft 11 lines ; height $5\frac{1}{2}$ lines ; width of fang 8 lines ; fore and aft $6\frac{1}{2}$ lines ; thickness 3 lines.

Of other species of *Ptychodus*, Agassiz mentions teeth of *P. mammillaris*, found in the excavation of the Delaware canal, and preserved in the Museum at Paris. (Pois. Fos. III, 151.) I have seen no specimens of that species from an American locality.

Synopsis of the Extinct BATRACHIA of North America.

BY EDWARD D. COPE, A.M.

BATRACHIA.

The vomer is double, and usually bears teeth in this class ; the premaxillary is usually double ; Amphiuma and Spelerpes b e l i i are exceptions. Teeth never planted in deep alveoli.

There are six orders, as follows :

TRACHYSTOMATA.

Candal vertebræ and frontal bones distinct.

Inferior pelvic elements not confluent.

O. o. maxillaria, prefrontalia, palatina and pterygoidea wanting ; nasalia present.

Ethmoid,* two lateral pieces, each forming part of palate.

Mandible toothless, condyloid.

No " postorbital and supertemporal bones."

First pair ceratohyals distinct.

PROTEIDA.

Candal vertebræ and frontal bones distinct.

Inferior pelvic elements not confluent.

O o. maxillaria, prefrontalia and nasalia wanting ; palatina and pterygoidea present.

Ethmoid,* a vertical plate on each side the cerebral lobes.

Mandible toothed, teeth pleurodont.†

* Erroneously called orbitosphenoids by me, Jour. Acad. 1866 (on Anura).

† The statement made by Dr. Gray that the teeth of *Nocturus* are canaled, as in venomous serpents, by a channel entering at the base and issuing below the tip, appears to the writer to be of doubtful accuracy. No other opening exists in the teeth of *Nocturus* m-

Ceratohyals, first pair connate.
No postorbital and supertemporal bones.

URODELA.

Usual cranial bones present, but pterygoids reduced or wanting.
No "postorbital or supertemporal bones."
Caudal vertebræ and frontal bones distinct.
Ethmoid a vertical plate on each side.
Mandible dentigerous, teeth pleurodont.
Inferior pelvic elements horizontal, in contact, no osseous pubis; ilium suspended to a sacral rib.
(Mostly no quadratojugal.)

GYMNOPHIDIA.

Usual cranial bones present and distinct, including frontals and pterygoids.
Caudal vertebræ distinct.
No "postorbital or supertemporal bones."*
Ethmoid an annulus surrounding cerebral lobes.
Mandible dentigerous; teeth anchylosed by their bases.†
(A quadratojugal.)

STEGOCEPHALI.

Usual cranial elements distinct, including frontals and pterygoids, and adding "postorbitals and supertemporals."
Caudal vertebræ?
Ethmoid normal.
Inferior pelvic elements distinct.
Mandible dentigerous; teeth with anchylosed bases, or
(A quadrato-jugal.)

ANURA.

Frontal and parietal confluent, nasals wanting or rudimental; other cranial bones present.
Postorbital, supratemporal and usually nasals wanting.
Ethmoid an annulus (usually complete above) surrounding cerebral lobes.
Caudal vertebræ represented by an elongate compound style.
Inferior elements of the pelvis consolidated into a single vertical mass; ilium attached immediately to sacral vertebra.
Quadratojugal.

STEGOCEPHALI.

XENORHACHIA.

The vertebral centra not ossified; ? the dentition pleurodont; teeth simple; ? no branchial hyal bones. ? Occipital condyles.

culatus than the emargination at the base of the root occupied by the growing crown of the successional tooth, as in other Batrachia. If the structure described by Dr. Gray exists, it is in a species as yet unexamined by American zoologists. Professor Winchell, of Ann Arbor, confirms my observation.

In my Synopsis of higher groups of Batrachia (Journ. Acad. Nat. Sci. 1866), I stated that *Amphiuma* possesses minute scales. Gray, in 1850 (Catalogue Brit. Mus.), makes the same statement, which Duméril (1863, Catal. Mus. Paris) contradicts. I must accord with Prof. Duméril, since a subsequent examination has convinced me that they do not exist. The specimen in which the appearance of scales was presented was mislaid at the time of writing, and I find it was due to numerous free portions of the true derm, which are continuous with the attached portions.

* When the temporal fossa is overarched it is by expansion of the maxillary and quadratojugal. (Stannius says "aquama temporalis.")

† The teeth of *Cecilia* are compressed with a trenchant posterior edge, which is crenate, after the manner of *Megalosaurus*, *Carcharias*, etc. Thus to the numerous genera of *Saurians* and *Selachians* possessing this character, must be added a *Batrachian*.

1868.]

MICROSAURIA.

Vertebral centra ossified; no branchial hyoids; teeth simple or with slightly inflected enamel, pleurodont. Occipital condyles.

GANOCEPHALA.

Vertebral centra cartilaginous; branchial hyoids present; teeth with slightly inflected enamel, ankylosed by their bases. No ossified occipital condyles.

LABYRINTHODONTIA vera.

Vertebral centra osseous; no branchial hyoids; teeth with much inflected enamel, ankylosed by their bases. Occipital condyles.

XENORHACHIA.

This order I proposed for the reception of the genus *Amphibamus* Cope, in 1865. I proposed to regard, as one of its characters, the existence of opisthocælian vertebræ. Such impressions were observed in the matrix in which the fossil was preserved, as to induce a belief in the existence of such vertebræ, and the existence of these in a well ossified condition, in the apparently nearly allied genus *Pelion* Wyman, strengthened such belief. There were actually, however, only osseous neural arches present, and I am now decidedly of the opinion that the vertebral centra were either cartilaginous or annuliform, as in *Archegosaurus*.

AMPHIBAMUS Cope.

Proc. Acad. Nat. Sci. Phila. 1865, 134.

AMPHIBAMUS GRANDICEPS Cope, Proc. Ac. N. Sci. Phila. 1865, p. 134. Palæontology Ill. State Survey. Tab.

Carboniferous; Lower Coal Measures, Morris Co., Illinois.

MICROSAURIA.

This sub-order was established by Prof. Dawson, for small lizard-like vertebrates from the Coal Measures, which he thought presented points of affinity to, or should be from the Saurian reptiles, at the same time recognizing Batrachian characteristics.

After examining the evidence brought forward by Prof. Dawson, it appears to the writer that the Saurian characteristics are analogical only, and not indicative of true affinity, and that these creatures form, in fact, a series closely resembling or parallel with what was probably an immature stage of the Labyrinthodontia. They are in fact Labyrinthodonts, with simple or very slightly inflected enamel of the teeth, and with the extent of the exostosis of the cranial bones much reduced. This character has been much overrated by some authors. In the *Dendropeton obtusum* Cope the grooving and pitting exists only on the posterior parts of the cranium, and gradually disappears anteriorly. In the *Alligator mississippiensis* the same is the case.

The points in which they have been said to resemble the Lacertilia, are, 1st, the dermal scales; 2d, the parietal fontanelle; 3d, possession of ribs. All of these features belong to the Labyrinthodontia; the Xenorhachia also had scales. On the other hand, the two occipital condyles, indicating the existence of a parasphenoid bone, distinguishes it at once from all the Allantoid vertebrata, and the form of the vertebræ is very Batrachian. In the Lacertilian families of Geckoniidæ and Hatteriidæ only we have biconcave vertebræ, but the concavities are comparatively shallow, and the vertebræ less constricted medially than in the Microsauria. Those of the latter are much like those of Salamanders, according to Prof. Dawson's figures.

The bones figured as pelvic are unlike those of any Batrachia or Lacertilia known to the writer. But until those of the Labyrinthodontia are discovered,

[Sept.

we cannot assert that they differ from the latter. The long spatuliform elements figured as pelvic are, perhaps, scapulæ, which are of not very different type in the Trachystomata, Proteida, and the Ganocephala.

The only species included in this tribe in which inflections of the enamel have been described, is the *Dendroperpeton acadianum*, and here it is only at the base. It is, however, not impossible that this genus should not be associated with *Hylerpeton*, *Oestocephalus*, etc. The genera *Urocordylus*, *Cera-terpeton*, *Lepterpeton*, *Ophiderpeton* and others recently described by Prof. Huxley, also belong here.

PELION Wyman.

In litteris. *Raniceps* Wyman, Amer. Jour. Sci. Arts, 1858, 158. Not of Cuvier (Pediculati).

PELION LYELLII Wyman. *Raniceps lyellii* Wyman, l. c.

This animal differs from the genus *Amphibamus* in the well-ossified vertebral axis; no remains of a tail with elevated neural spines exist in the type specimen, and no ventral scales are seen in it.

Middle Coal Measures, Jefferson Co., Eastern Ohio.

HYLONOMUS Dawson.

HYLONOMUS LYELLII Dawson, loc. cit. viii, 167.

The Joggins. Nova Scotia Coal Measures.

HYLONOMUS ACIDENTATUS Dawson, l. c. viii, 258.

Coal Measures; with the last.

HYLONOMUS WYMANII Dawson l. c. viii, 270.

Coal Measures, Nova Scotia; with the last.

PARIOSTEGUS Cope.

This genus is represented by a large part of the cranium of a Batrachian from the triassic coal measures of Chatham Co., North Carolina. If not a Batrachian, it could only belong to a ganoid fish, but though some of its characters are somewhat ichthyic, it lacks the following important elements of the ganoid structure, i. e., free post- and suborbital bones; postnarial cavities; branchiostegal, and arched branchiyl bones. On the other hand it has a large preorbital, bounding the frontal and maxillary to the nares, and the inner border of the orbit as in Stegocephalous Batrachia; also a postorbital element contributing to the formation of an extended supratemporal roof.

Contrary to what has been found the case in most genera of Stegocephali, the maxillary appears to extend posteriorly to a free termination, as in modern Salamanders, and the supra-temporal bone presents a very prominent, obtuse, arched margin. This margin extends from the orbits on each side, and is incurved towards the posterior part of the cranium. There is therefore no quadratojugal piece.

The maxillary and mandibular pieces are slender, flat bones, as in *Menopoma*; the form of the posterior or articular portion of the latter cannot be ascertained from the specimen. The more or less exposed part of the median region of the latter exhibits a succession of shallow transverse notches, enclosing thirteen obtuse elevations. The former resemble rudimental lateral alveolæ for minute pleurodont teeth. A few other similar minute ribs, and perhaps a minute curved cone without sculpture, are the only other indications of dentition.

The bones of the upper surface of the cranium are most readily interpreted by reference to those of *Menopoma*. A pair of narrow nasals, acuminate behind, penetrate between the frontals as far posteriorly as the posterior margins of the orbits. The suture between these is very distinct, and entirely straight. The preorbitals extend to above the orbits, and there appear to cease with a transverse suture. Between these and the nasals a broad triangular element enters 1868.]

on each side, not attaining the probable position of the nostrils. Each is divided by a longitudinal groove, which is probably a suture, and which would then divide the frontals from the parietals. The frontals would then divide the parietals entirely, as they do in *Menopoma* for the anterior half of their length. This would give the frontals a narrow form, acuminate in front, and bounded behind by a regular coarse, zig-zag transverse suture. The cranium behind this point is rugose, and the surface not well preserved, and it can only be said that two irregular grooves converge to a point between the posterior extremities of the frontals, like the boundaries of the supraoccipital. The posterior boundary of the cranium with the condyles cannot be readily determined. When the postorbital roof bone is raised up, the meeting of two gular dermal bones, as I interpret them, is seen. One of these is a plate directed backwards and outwards, bearing minute radiating lines on its upper surface. It meets a similar flat plate directed forwards and outwards, with similar lines radiating to the circumference. The inner margins of these plates were not seen.

The orbits are remarkably small, and situated probably near the middle of the longitudinal measurement of the cranium. The external nares are not defined, but symmetrical depressions in the position they usually occupy in *Salamanders* are distinct.

The general form recalls *Menopoma*, particularly the necessarily small eyes. A slender curved bone with a slightly dilated and truncate extremity, lying by the cranium in connection with the mandible, is like a branchiyl of that genus. Nevertheless it cannot be positively assigned to this genus, as numerous scales of cycloid fishes are on the same block.

PARIOSTEGUS MYOPS Cope.

The surfaces of the cranial bones are little sculptured; there are small tuberculiform elevations on the parietals and more numerous ones on the pre-orbitals. The postorbitals show the strongest markings of elongate pits which radiate to their circumference, leaving a smooth obtuse border. The nasals present a series of small warts at a little distance on each side of their common suture, and transverse to it. The surface of the maxillary is marked with longitudinal grooves and shallow pits.

No suture separating maxillaries and premaxillaries can be traced with certainty, though the bones of the jaw are interrupted at the usual place of suture, opposite the nostril.

Measurements.

| | Lin. |
|---|------|
| Length of specimen (including mandible)..... | 18 |
| Width between outer convexities postorbitals..... | 17 |
| “ “ inner borders orbits..... | 11 |
| “ of same without preorbitals..... | 8 |
| “ of nasals at middle..... | 2.5 |
| “ orbit..... | 1.5 |
| Length of frontal nasal premaxillary..... | 11. |
| “ “ supposed branchiyl..... | 12. |

The name is derived from the roof-like postorbitals with free lateral margin.

Locality.—Coal bed of the Keuper Triassic, Chatham Co., North Carolina. The species was discovered by Prof. Jos. Leidy, who handed it to me for description. It is in the Museum of the Academy of Nat. Sciences of this city.

DENDRERPETON Owen.

Journal Geol. Soc. London, 1853, p. 81.

In the form of the cranium this genus differs from *Brachydictes* and *Ophiderpeton*, much as *Menopoma* does from *Amphiuma*. Two species appear to have left their remains in the coal measures at Linton, Ohio.

[Sept.

DENDRERPETON OBTUSUM Cope.

This species is known by a partially preserved cranium. The superior surface is exposed, the outlines of the jaws and orbits are well preserved, with the occipital condyles. The os-quadratum is directed obliquely backwards, and the angle of the mandible extends to a line a little behind that of the occipital condyles. The zygomatic arch exists in a position similar to that in which it may be seen in a few genera of Anura, as *Discoglossus* and *Pelobates*. It extends downwards and forwards from the suprasquamosal to the maxillary region, but whether it is homologically squamosal or malar, the specimen cannot show. The postorbital is present as well, and with the last, and the supratemporal forms the bony roof of the temporal fossa. A piece which may be the pre- and postfrontals combined, borders the inner superior margin of the orbit; it widens posteriorly, where it has contact with the parietal, etc., and narrows in front. Supra-occipitals form together a broad triangle on the upper plane of the cranium, of less extent than the adjoining supratemporal. The latter elements are pitted, and towards their margins radiate grooved. These sculpturings grow less on the margins of the supratemporal, and the portions of the surface of the more anterior element remaining are so slightly marked as to give the impression that the sculpturing in this species is much less than in others of the genus. A few beaded ridges are all that remain on a few of the parietals and postorbitals; the maxillaries have a slightly stronger sculpture seen in a few spots.

The general form of skull is elongate behind, and much shortened in front of the orbits. The orbits are thus altogether in front of a line equally dividing the cranium transversely, while in the *D. acadianum* Ow. they are in the middle of the skull. The outline of the muzzle in one species is thin, broad, rounded, as in the *Menopoma allegheniensis*, while in the latter it is ovate and produced.

The parietal bones extend to opposite the posterior margins of the orbits, are then gradually contracted and form an acuminate prolongation on each side the wedge-shaped frontals. The prefrontals are thickened on each side the front, behind the external nares. The sutures defining the frontals anteriorly, the nasals, and the premaxillaries behind, cannot be made out. The median longitudinal suture is a marked and zigzag one, and can be seen as far posteriorly as the anterior margin of the orbits. The external nostrils are large and opposite the inner margin of the orbit on each side. This separation of the nares is associated with a greater transverse extent of the premaxillaries than in some of the genera. These have been set with numerous teeth, judging by their small impressions; no larger ones have left traces, and no traces of any on the maxillaries. The teeth of the genera before described are all much larger relatively, indicating still further the diversity between them.

A fragment of mandible remains, but without teeth or external surface. It shows a large internal canal.

Measurements.

| | Lines. |
|---|--------|
| Total length cranium | 25.5 |
| Width cranium 3 lines behind orbits | 24 |
| “ between orbits | 7.5 |
| “ “ nares | 5. |
| “ “ occipital condyles | 2.2 |
| “ of supraoccipital bones | 6 |
| “ of right parietal | 6 |
| Extent of premaxillaries | 8.7 |
| Length orbit | 6 |

From the Coal Measures at Linton, Columbiana Co., Ohio, (West Pennsylvania Basin). Discovered by Dr. John S. Newberry.

Another cranium accompanies the collection which belongs to a species described 1868.]

tinct from the last. The muzzle is not so broadly rounded, and the premaxillary teeth are relatively much larger. The sculpture is more delicate, with the ridges more acute. The orbits and nares are not defined. The maxillary is well preserved for a length of an inch; its teeth are smaller than the premaxillaries; I count four in a line; crown simple conic. External surface of maxillary not very strongly sculptured.

This species cannot be referred to its genus without further material. I therefore do not name it, hoping to avoid the unworthy practice of some, who give *prospective* names—to be applied to other peoples future discoveries, and the like.

DENDRERPETON ACADIANUM Owen, Quart. Journ. Geol. Soc., x, 1853, 81. Dawson loc. cit.

Coal Measures: Joggins of Nova Scotia.

DENDRERPETON OWENII Dawson, Canadian Naturalist and Geologist, viii, 161.

Coal Measures: as the last.

HYLERPETON Owen.

HYLERPETON DAWSONI Owen, Journ. Geol. Soc. Lond., 1862, 241. Dawson, Canadian Naturalist and Geologist, viii, 272.

Carboniferous Coal Measures. The Joggins, Nova Scotia.

BRACHYDECTES Cope.

This genus is indicated by two rami of a mandible, and a portion of a premaxillary only. These, when compared with those of *Oestocephalus* and *Dendrerpeton* from the same locality, and with others described by authors, are so much stouter, i. e. shorter and more elevated, that they evidently pertained to a genus not hitherto known. The genus further differs from *Oestocephalus* in having the teeth of equal size to the posterior parts of the series, that is to the base of the elevated coronoid process. The teeth are elongate cylindric cones, with their acute tips turned a little posteriorly. The fractured ones display a large pulp cavity. The three premaxillaries preserved are similar but without curvature of the tips. They do not exhibit striæ or any other sculpture. So far as the remains known go, the genus is nearer *Hylerpeton* than any other. The latter does not give any indication of the very elevated coronoid process of *Brachydictes*, though the external portion of the dental bone in that region being lost, little can be said about it. Prof. Owen's plate indicates a ramus whose depth at the last tooth enters $8\frac{1}{2}$ times the total length. In our species this depth enters about five times. There are at least nine teeth in the Nova Scotian species; seven in the present one.

BRACHYDECTES NEWBERRYI Cope.

This species is represented by one nearly perfect ramus mandibuli, one dentary bone, and one premaxillary probably not complete.

The dentary bone appears to have been attached by suture to the articular and angular, as its free margin has very much the outline of that suture in *Amphiuma* and lizards. The coronoid process would also seem to be a part of the same bone as in *Amphiuma* and *Menopoma*, and not composed of a coronoid bone as in lizards. It rises immediately behind the last tooth, and displays no suture.

The lower portion of the dentary is prolonged into an acute angle. This is separated by a deep and wide concavity from the superior posterior prolongation, which is obtuse and rises at once into the coronoid process. Teeth on this dentary seven; the same number is on the preserved ramus; this number I suspect to be complete or nearly so. The teeth terminate at the obvious termination of each ramus, which is it is true slightly obscured. The teeth are the longest of the *Microsauria* in relation to the depth of the ramus, equaling the largest in *Ophiderpeton*. They are doubtless exposed, as are some of

[Sept.

those of the last named genus, by the splitting away of the outer parapet of the dentary bone. As no traces of alveoli have been thus rendered visible, I suspect the dentition to have been pleurodont, as in existing Batrachia.

No external surface of the mandible remains, but there are no impressions of sculpture on the matrix. A little external face of the premaxillary displays none.

Measurements.

| | Lines. |
|--|--------|
| Preserved length of ramus (imperfect)..... | 11. |
| Depth at last tooth..... | 2. |
| Length of exposed tooth..... | 1·7 |
| “ dentary..... | 7·5 |
| Depth at coronoid..... | 3·5 |
| “ at first tooth..... | 1·3 |

SAUROPLEURA Cope.

Neural and haemal elements of the caudal vertebræ elongate, distally dilated and grooved, attached by contracted bases. Ventral aspect defended by a series of oblique dermal ribs on each side, which meet anteriorly on the median line. Limbs distinctly developed. Ribs long, well developed. Scales none.

No dermal bones have been discovered, nor are any portions of the cranium known.

This genus is allied to the *Urocordylus* of Huxley, recently discovered in the coal measures in Leinster, Ireland. It differs only in the presence of elongate lizard-like ribs (whence the name), and in the absence of “oat-shaped scales” of the upper surfaces.

It is a matter of much interest in American palæontology that this remarkable type should be found to occur in our coal measures. It was first announced by Dr. Newberry at the meeting of the American Association for the advancement of Science for 1867 (see Proceedings, p. 144), as a supposed *Urocordylus*, occurring with *Ophiderpeton*. He mentioned at the same time the discovery of the ganoid *Dinichthys* Newb.

The forms discovered by Dr. Newberry have an interesting relation to those of Ireland, such as types of the present period frequently present.

The genera may be thus parallelized; where no representation exists, we may look forward to a future discovery to supply the present want:

| | | |
|-------------------------------|----------------|----------------------------|
| <i>Ceraterpeton</i> Huxl., | represented by | |
| <i>Urocordylus</i> Huxl., | “ | <i>Sauroplesura</i> Cope. |
| <i>Lepterpeton</i> Huxl., | “ | “ |
| <i>Dolichosoma</i> Huxl., | “ | <i>Molgophis</i> Cope. |
| <i>Ophiderpeton</i> Huxl., | “ | <i>Oestocephalus</i> Cope. |
| | | <i>Brachydictes</i> Cope. |
| <i>Herpetocephalus</i> Huxl., | ? ? | <i>Dendroterpeton</i> Ow. |

Of the American genera, *Sauroplesura* and *Oestocephalus* exhibit the peculiar ventral dermal armature of *Urocordylus* and *Ophiderpeton*, while *Molgophis* does not possess it, nor *Dendroterpeton*, if our species truly belongs there.

The museum of Columbia College, New York, contains portions of two species of *Sauroplesura*, but both unfortunately represented by portions only of the vertebral column. These are, though closely resembling the species described by Prof. Huxley, sufficient to demonstrate marked generic distinction. This is further established by the remains of the trunk of a third, and larger species, whose relationships can be shown to lie within this genus. This individual has been spread over a surface of the coal slate, exhibiting ventral armature, dorsal region with ribs, and anterior and posterior limbs. Of skull and caudal vertebræ nothing remains.

The dermal riblets are arranged as in *Urocordylus*, *i. e.*, in parallel lines directed obliquely forwards and continuous on the median line, forming there a
1868.]

chevron, directed forwards. The stræ are not so closely placed as in *U. pectinatus*, but are separated by grooves wider than themselves.

The humerus, ulna, and radius are rather stout, and of a size relative to the body, as in common types of existing Sauria; the ulna and radius separate. There is no carpus, but five well-developed digits have phalanges in the following numbers, commencing on the inside: 3—4—5—6—5. The last phalange of the second is obscured, and it is not positive that the number is as given; it is more probable than that it should have been 3. The outer toe has been more slender than the others; the distal phalanges of all the toes are short conic, as in Salamanders. Thus this form differs much from *Amphibamus*, where the numbers are 3—3—4—5—4, showing a lower development of limbs.

The ribs are long and curved, as in Reptiles, and judging by their distances the vertebræ are short; the latter are not well defined, but there is no indication of prominent spines of any kind.

The pelvic bones and portions of those of the hind limbs are present, but so obscure and confused as not to be made out. Enough remains to show that the hind limbs are considerably larger than the anterior.

SACROPLEURA DIGITATA Cope.

This species had a length of body about equal to that of a fully-grown *Chamaeleo vulgaris* of the largest size, or of a half-grown *Menopoma*. Thirteen ribs on one, and several on the other side, are preserved; where they terminate, probably at the pelvic region, some small or rudimental ribs project from the two or three first caudals. Three ribs and their interspaces extend over five lines. The humerus is broken, but its length can be clearly made out to be seven lines; it has no condyle, and is dilated at both extremities. The ulna and radius are distinct, truncate, hollow, and dilated at the ends. Length of ulna 5.1 lines, distal width 1.8 lines. Carpus not ossified. The fourth toe is considerably longer than the others, the fifth is next, and reaches the basal third of the antepenult phalange of the fourth; the third is very little shorter; the first is not quite so long as the first two of the third. The bones of the hind limb are not readily distinguished. They are evidently much longer and larger than the anterior; no part of a foot is preserved.

This form is probably allied to *Urocordylus*. It has relatively much stronger ribs in relation to the vertebræ than we have seen in that genus, and there is no evidence of the existence of the peculiarly formed spines of the vertebræ characterizing the latter. The limbs are relatively much stronger than in *Ophiderpeton*, and it lacks the peculiar dermal armature of that genus.

SACROPLEURA PECTINATA Cope.

This species is represented by portions of the vertebral columns of four individuals. In two of these, vertebral centra are discoverable; in one quite definitely. They are slightly constricted medially, and without ridge or process.

The neural and haemal spines of superior and inferior lines are similar, and in the specimens undistinguishable. The dilated portions form nearly equilateral triangles, which stand on moderately short pedicels. They are weakly ridged, and each ridge is prolonged into a narrow acute tooth, beyond the margin, of which eleven may be counted on one of the best preserved. The longitudinal stræ are terminated near the pedicel by two others, which cross obliquely from each side, and, meeting, present an appearance similar to an overlapping of each margin. The edges of the spines form a continuous line.

As in the other species, there are no indications of other processes, nor of dermal scales.

The smallest of the specimens shows that in front of the region furnished with the peculiar spines described, the body is furnished with a mass of bristle- or hair-like scales. The grooved neural spines are slightly displaced anteriorly, and the bristle-like mass looks like a continuation of their stræ, and it is not easy to find any line of demarkation between them. The serrate spines are

[Sept.

continued further forward on one side than the other. These linear scales were arranged as in other genera, in lines which converge forwards to the median line. They are somewhat obscured in the specimen, but it can be determined that they are continuous on the median line. Whether this is the posterior or anterior portion of the body cannot positively be determined from the specimen; it is, however, most likely the posterior, for near the posterior portion of the striate surface a weak pair of limbs is given off on each side. On the right, a moderately stout ? femur is followed by a broken tibia and fibula, and by five slender, closely appressed metatarsals. The last are about two-fifths as long as the space between them and the femur; beyond them a few slender phalanges are moderately distinctly defined. The tibia is more distinct on the left, but no tarsus or phalanges; some of the metatarsals are preserved here also. Length of limb to end of metatarsals equal to five vertebrae in juxtaposition, measured along the edges of the neural spines. The limb has been slender, especially the hand.

The above specimen enables me to assign, as the ventral armature of this species, a closely packed series of V-shaped grooves, which lie in connection with an obscure vertebral column, on the block containing one of the typical specimens of this species. They are not continuous with any of the series exhibited on other parts of the block; some of these at least are the doublings of the slender animal, and this ventral portion has been displaced. The grooves are perhaps the impressions of hæmapophysial rods, vastly more numerous, however, than the number of vertebrae; perhaps they are rather the dermal armature. Huxley figures a portion of this as on the block with *Urocordylus wandesfordii*, but does not refer it to its precise relation to the animal. A few well-developed ribs are preserved with this portion,—the only ones I can refer to this species. The vertebrae are partly enclosed in matrix, partly impressions. The neural spines, though expanded antero-posteriorly, are less elevated than in the caudal region, and have left no traces of their characteristic ribs or serration.

The number of spines in the type specimens is six in a half-inch; in the smallest, just described, ten in the same distance. The height of the spine in the former is 1.15 lines.

As the characters of this species are most determinable, I regard it as the type of the genus *Sauropleuræ*.

SAUROPLEURA REMEX Cope.

This species is larger than the *S. pectinata*, and about equal to the *Urocordylus wandesfordii* Huxl. The caudal spines differ from both in the greater attenuation of the hæmal series, and the presence of a basal lumina on the neural.

It is represented by a portion of the vertebral column three inches in length. In this space may be counted twenty-four vertebrae. Such of the latter whose outlines are visible display centra, characteristic of the genus; their terminal concavities conic, with apices meeting medially; zygapophyses present; and their length a little greater than their depth.

The characteristics of the species are the remarkable length and slenderness of the fan-shaped neural and hæmal spines, and the absence of an acute serration on their margins. In this species the spines have a laminiiform expansion at the base in their planes. In the other species here described these spines are not only relatively broader and more fan-shaped, but they are acutely serrate on the margin and constricted at the base.

In *S. remex* the dilated neural spines are a little more than three times as long as they are distally wide, while the hæmal spines are a little narrower. The neural spines stand about the middle of the centrum. The basal half is furnished with an anterior ala, which leaves the anterior margin rather abruptly and extends to the next spine in advance. It returns gradually to the centrum and is separated from the articular face of the latter by a notch. A

similar ala exists on the posterior margin of the neural spine, which extends for a shorter distance above the base, and is narrower than the anterior. Each spine presents a median groove on its surface, which extends half way to the base or further; on each side of this are some three other grooves, which extend but a short distance; surface otherwise smooth. The ends of the grooves slightly notch the truncated end of the spine.

The hæmal spines are on the posterior portions of the centra, and in contact with the anterior part of the basis of those succeeding. They are without the dilatations of the neural spines, and are directed rather more obliquely backwards. They are similarly grooved, though without that so distinctly median, seen in the neural series.

Both neural and hæmal spines become larger towards the posterior part of the vertebral column. There appear to be no zygapophyses nor diapophyses, nor rudiments of ribs. The centra are rather stout, and somewhat constricted medially. There are no traces of dermal armature of any kind.

Measurements.

| | <i>Lines.</i> |
|--|---------------|
| Length of a posterior centrum..... | 1·2 |
| Depth " " "..... | 1· |
| Length neural spine of adjoining vertebra..... | 4·4 |
| Basal width..... | 1·4 |
| Median width..... | ·9 |
| Distal width..... | 1·1 |
| Length of a more anterior neural spine..... | 4·3 |
| Distal width " " " "..... | 1·5 |
| " anterior hæmal spine..... | 4 |
| " width " "..... | 1·4 |

From the Coal Measures, the Western Pennsylvania and Ohio Bituminous Basin, at Linton, Columbiana Co., Ohio, near the Ohio River. Prof. J. S. Newberry.

OESTOCEPHALUS Cope.

This genus is known from a single species as yet. As before remarked, it represents in many respects the *Ophiderpeton* of Huxley, and has been alluded to by Dr. Newberry as the same. It, however, differs markedly in the narrow lanceolate form of the head, with probable accompanying peculiarities of detail, and in the presence of limbs, which have not been found in the Irish genus. The form of the head is somewhat nearer that of *Lepterpeton* Huxl., but the limbs of the American genus have as yet been seen as one pair only, and very small, while in *Lepterpeton* there are two pairs, which are large. The general form of the body of *Oestocephalus* is more snake-like.

In more detail, we have an elongate lanceolate head with little or no sculpturing of the external surface of the bones. The angles of the mandibles are much prolonged backwards as in *Archegosaurus* and frogs, and the well developed ribs commence but a short distance behind the head. The vertebrae are slender, and furnished with well developed diapophyses. A pair of symmetrical bones, whose impressions are seen posterior to the occipital region, look like ceratohyals or small scapulae, and one of them is continuous with a second piece, which occupies the place of a humerus. A third piece follows, which is probably ulna; no radius or manus is preserved. This then is a rudimental fore limb, situate very close to the head. The skin has been occupied by a great number of closely packed, curved, spine-shaped scales. They have occupied the ventral integument passing from the median line of the belly outwards and posteriorly, having acute tips which may have penetrated the skin on each side; whether such tegumentary spines protected the back cannot now be determined.

[Sept.

ORSTOCEPHALUS AMPHIUMINUS Cope.

This species is represented by the imperfect crania and anterior portions of the bodies of two individuals. They indicate an animal of the average size of the *Amphiuma* means.

The extremities of the vertebræ are deeply concave, but the centra are so long as to prevent the concavities entering more than one-fifth of the latter, each. The diapophyses are behind the middle, and are broad, curved backwards, and acuminate, as in *Amphiuma*. The centra have a prominent median line below, with a longitudinal concavity on each side. Five of them a little exceed an inch in length. Neural spines are nowhere visible. The humerus is longer than the scapula and is considerably dilated distally; the scapula slightly dilated at its superior extremity.

The dermal armature commences immediately behind the head, and forms a band of 14 lines in width; measuring across the spine-like scales, in a width of a line, four cylinders may be counted. The external portions are carried backwards, the interior nearly straight, those of the anterior more delicate than the posterior.

The head is wedge-shaped with regularly acuminate sides. The top of the cranium is somewhat broken in the specimen; the portions preserved are smooth, and the longitudinal suture is distinct for a considerable distance. The angle of the mandible is produced considerably behind the occiput and is enlarged and rounded. The end of the muzzle is broken away, and the region of the orbits so fractured as to render their precise location uncertain. The superficial layer of the cranial bones is nowhere clearly visible, so that it cannot be ascertained whether it is sculptured or not. The quadrate bone projects well posteriorly. Some fragments indicate small cylindric teeth, as in *Amphibamus*, but they are not characteristic.

Measurements.

| | Lines. |
|-------------------------------------|--------|
| Length cranium without muzzle..... | 17.3 |
| Width " posteriorly..... | 11.5 |
| Length scapula..... | 2.1 |
| " humerus..... | 2.5 |
| " of sixth vertebra from skull..... | 3 |
| Extent diapophyses..... | 3.5 |
| Width centrum..... | 1.5 |

This species was discovered by Prof. Jno. S. Newberry, at Linton, Eastern Ohio, in the slate of the coal measures. Mus. Columbia College.

The characters of the genus are further shown by a part of another individual in the same coal slate matrix. The cranium and anterior portion of the vertebral column only are preserved, the latter so much injured as to render the vertebral characters very obscure. As in the other, the bristle-like scales extend along the dorsal region to near the cranium. The anterior two-fifths of the ventral side shows a large number of small oval scale-like bodies, which belonged undoubtedly to the animal and were probably dermal scales. They are, however, neither regular in form or position. Close behind the head two or three long bones of the fore limbs have been exposed. They are slender, and similar to those of the last specimen.

The cranium, though without the muzzle, shows its long wedge shape. The maxillary bone cannot be distinguished, nor can the orbits be made out; one ramus mandibuli is pretty well preserved; it shows no coronoid process. Twenty-one teeth may be counted on a portion a little more than one-third its length. The anterior eleven of these are abruptly longer and stouter than the others. They are, except a few most anterior, in pairs, *i. e.* with a slight vacancy between every two. The larger ones were broken at the bases, exhibit a moderate pulp cavity; the smaller, a large one extending to near the tip. Several, though not all of the larger teeth, display a shallow groove on the ex-

ternal face to near the tip, which is probably owing to pressure, and a partial crushing. The points of the larger teeth are rather abruptly acute, and turned abruptly backwards. A portion of their increased length ($\cdot 25$) is to be attributed to the splitting off of the external dentary margin, and the exposure of the roots. No alveoli are shown, and the dentition is probably pleurodont, with ankylosis of expanded base as in true Labyrinthodonts.

MOLGOPHIS Cope.

This genus is established on remains represented by three specimens, which are two series of dorsal vertebræ with ribs, and a series of caudals. One of the dorsal series embraces sixteen vertebræ, the other fourteen; the caudal series, twenty-two.

From its serpentine form this genus may be compared with the *Dolichosoma* of Huxley, though a close relation does not exist between them. In the Irish genus the series of caudal vertebræ is quite short, and the ribs are short and but little curved. In *Molgophis* the tail has been like that of an elongate serpent, and the ribs are as well developed as those of many reptiles.

Though no limbs or arches can be certainly found, a rather quadrate, parallelogrammic piece, about as long as the diameter of a vertebra, may be a femur. This is, however, very doubtful.

The characters of the genus are, a long serpentine body, without dermal armature, so far as discoverable; the vertebræ large and broad, with very prominent zygapophyses and moderate neural spine, those of the caudals without narrowed bases (and grooved or serrate edges, most probably). ? Limbs and cranium unknown.

This genus differs from *Urocordylus* in its caudal vertebræ, and from *Ophiderpeton* in its dorsals; the latter, in their zygapophyses projecting laterally, resemble those of *Amphiuma*. It differs from *Sauropseura* in the absence of ventral dermal bands and in the longer body, without indication of limbs. The size of the vertebræ would indicate a body of the size of a rattlesnake, (*C. horrida*), and therefore too large for the species named *Brachydictes nqwberryi*.

The ribs are long, and though the head is not bifurcate, there appear to be both tubercle and head on the dilated extremity. They show themselves, where crushed, to have had a large median vacuity.

MOLGOPHIS MACRURUS Cope.

The neural arches, viewed from above, have a posterior V-shaped outline, from the fact that the broad zygapophyses meet on the median line, and spread out distally over the broad anterior ones adjoining. The latter appear to be somewhat concave, and to border the former exteriorly as well as inferiorly. The base of the neural spine extends to the posterior emargination, but not quite to the anterior. The breadth of the dorsal vertebra above is equal from the emargination behind to the anterior margin of the anterior zygapophyses.

The caudal series must have been very long, as there is very little diminution in the size of the vertebræ throughout the series preserved. They present much the same form as the dorsals, but are more contracted medially, and the zygapophyses have a more transverse direction. There may indeed be a diapophyseal element beneath these, but the two cannot be distinguished if so. They are connected by longitudinal impressions indicating the existence of the tendinous bands in the longitudinal muscles seen in *Amphiuma*, or the osseous apicules in the same situation in birds. The neural spines, indicated by their narrow bases, occupied the lengths of the neural arch, and remind one of *Amphiuma*.

The ribs are long for a Batrachian, but shorter than in a reptile. They are well curved, chiefly near the proximal extremity. The longest I can find, measured by a chord, equals two vertebræ and two-fifths. Three vertebræ

[Sept.

measured along the median line above equal eleven lines; one of these is 3·6 lines in width above; width of a (?) posterior caudal 3 l.

This animal has been, like *Amphiuma*, a snake-like Batrachian, but probably of even more elongate form. How near its affinities to this genus may be, cannot be ascertained, owing to want of important parts of the skeleton, but it differs in the important feature of the large, well developed ribs.

LABYRINTHODONTIA.

DITCYOCEPHALUS Leidy.

DITCYOCEPHALUS ELEGANS Leidy, Proc. Acad. Nat. Sci., 1856, 256. Emmons Geology North Amer., p. 59. Tab. 31.

Triassic Coal Measures, Chatham Co., N. Carolina.

CENTEMODON Lea.

CENTEMODON SULCATUS Lea, Proc. Acad. Nat. Sci., Phila., 1856, 78.

Triassic Shales near Phoenixville, Chester Co., Penn.

BAPHETES Owen.

BAPHETES PLANICEPS Owen, Quart. Journ. Geol. Soc. Lond. x, 1853, (xi, notes).

Carboniferous Coal Measures of the Joggins, Nova Scotia.

EUPELOR Cope.

Gen. nov. *Char.* Teeth subcylindric, with large pulp cavity at the basis only; external surface without grooves; dentine divided by numerous flat vertical laminae of a dense substance, probably enamel, which radiate from very near the pulp cavity to the external enamel layer.

The species on which this genus depends was originally described by the writer as a *Mastodonsaurus*. The latter genus, however, exhibits external grooves where the inflections of enamel enter and separate the dentine. These inflections, as is well known from the figures and descriptions of Professor Owen, are more or less convoluted, some of them very highly so. The laminae of the teeth of the *Eupelor* cannot be looked upon as inflections of enamel, but rather as branches. They are exceedingly thin, and our sections do not demonstrate them to be double. If they are double they are very much more attenuated than the external enamel stratum. They may be distinguished in a section of the wall of the pulp cavity at the base of the root as well as elsewhere.

EUPELOR DURUS Cope, *Mastodonsaurus durus* Cope. Proceed. Acad. Nat. Sci., Phila., 1866, 249.

From the Triassic Red Sand Stone near Phoenixville, Chester Co., Penn.

On AGAPHELUS, a genus of toothless Cetacea.

BY EDW. D. COPE.

During the autumn of 1866 a whale was cast ashore on the Long Beach, Ocean Co., N. J., opposite Westecunk, on the other side of Little Egg Harbor, near the residence of Wm. A. Crane. A recent visit to the spot furnished me with the means of determining the species to which this monster of the deep belonged, although not with the completeness desirable, as the tide had a short time previously taken off the most bulky part of the carcass. Thus the cranium, cervical and dorsal vertebrae, with the first ribs, the most important portions for its identification, were lost. There were preserved, however, the mandibular arch, ear-bone, one scapula and both fins, numerous ribs, many 1868.]

lumbar and caudal vertebræ, with the baleen from one side of the maxilla. These portions, with a few prominent points dependent on the observations of Wm. A. Crane, serve to indicate a species not only new to our fauna, but new to modern science. The evidence of my informant, as that of an old and experienced conister and waterman, and one familiar with the appearance of our cetaceans, confirmed by his sons and by the specimens preserved, so far as they went, I consider reliable. That the species should have remained undescribed until the present time will not appear surprising to those who read carefully Gray's recently issued "Catalogue of Cetaceans," or Eschricht and Reinhardt "Om Nordhvalen," Copenhagen, 1861.

The scapula preserved is low and elongate, with well-developed acromion and coracoid process. It is evidently of the type of *Balenoptera* and *Physalus*; the ulna and radius relatively less elongate than in *Sibbaldius laticeps* and *borealis*, being 1.5 as long as the humerus, thus resembling *Physalus*. The four fingers, with the second much the longest, form a fin of the type of these genera. The ear-bone is much more compressed than in *Physalus antiquorum* or *Sibbaldius laticeps*. The mandibular ramus is rather massive, moderately curved, and with a more elevated coronoid process than in any whale that I have seen. The greatest peculiarity is in the form of the lumbar and anterior caudal vertebræ; they are of a much more elongate form than any I have seen or found figured, excepting those of the *Balenoptera rostrata* (as figured by Gaimard in *Voyage de la Recherche*), which, however, are relatively shorter. Those of the present species are of greater length than transverse diameter, the lumbar most elongate; all furnished with an acute hypapophysial keel and concave sides, and entirely transverse diapophyses. This peculiarity is consistent with the account of my informant, who stated the animal to have been of an unusually elongate and slender form. When it came ashore it had perhaps been dead ten days; the flukes and muscular region as far as the third caudal vertebra had been devoured, probably by sharks and killers, and the abdominal region much lacerated; the edge of a fin preserved was slit by the teeth of some carnivorous enemy. The measurement from the end of the muzzle to the end of the third caudal was 35 feet, which may be reduced to 33 feet axial. Up to this point the dorsal line was, according to my informant, entirely smooth, without knob or fin, or scar of one; hence I suppose the fin (if present) to have been situated as in *Sibbaldius*, &c., at the posterior fourth of the length, and not as in *Balenoptera*, on the posterior third. It may then be safely assumed, bearing in mind the form of the vertebræ, that ten feet of the whale's length had been removed, making in all 43 feet. That the species attains over 50 feet is probable, as the present individual was quite young, the epiphyses separating from the vertebræ with the greatest ease. The slender form of the animal is corroborated by the slenderness and slight curvature of the ribs, one attached beneath the scapula, probably the second, being narrower than the corresponding ones in *Sibbaldius*. I therefore think it most probable that in this form the anterior ribs are single-headed.

The baleen is peculiar; throughout the length of the maxillary bone it nowhere exceeded one foot in length, and the width of the band, or length of the base of each plate, four inches. It is of a creamy-white; the fringe very coarse, white, and resembling hogs' bristles.

The proportions in most respects present a contrast to those of *Physalus* species, and *Sibbaldius* species. While the cranium and fin of the *Physalus antiquorum* are of about equal length, the latter is four-sevenths the former in the present species. In the *Physalus* the cranium enters the length 4.7 times; in *Sibbaldius laticeps* 4.06, and in the present species 6.6 times; in *Balenoptera rostrata* 4.5 times.

In general features this Cetacean seems to be an intermediate form of the toothless whales; and an additional feature, which depends on the observation of my friend W. Crane, and in which I cannot conceive it possible that he should be mistaken, indicates still more conclusively that it pertains to a genus

[Sept.

not before characterized. The whale was first driven on shore on its back, and the gular and thoracic regions were seen to be entirely without ridges or plicæ of any kind, but as smooth as any other part of the body, or as the throat of a right whale, *Balæna cisa rctica* Cope, which is not uncommon on the same coast.

This my informant told me was the species known among the whalers as the "Scrag Whale." Though this name is indefinite when applied by whalers of different nationalities, it is probably used with accuracy by those accustomed to any particular region. At any rate I have little doubt that this is the species called by the same name by Dudley, who in 1725 wrote an account of the whales known by the whalers of the coasts of New England. He says it is near the right whale (*B. cisa rctica*) in figure also; "is near akin to the fin-back, but instead of a fin upon its back, the ridge of the after part of its back is scragged with half a dozen knobs or knuckles. He is nearest the right whale in figure and quantity of oil. His bone is white, but won't split." This is published, with an account of the other species known, in the 33d volume of the Philosophical Transactions. He mentions particularly the fin-back and hump-back whales, describing the deep folds of the chin, throat and sides of those genera. There can be little doubt that his "scrag whale" had a smooth throat like the *Balæna*, and not a plated one like the *Balænopteras* and their allies. By the preceding account it has been shown that the species has but four slender fingers at the carpus; hence it is obviously the type of genus intermediate between *Balæna* and *Megaptera*, not hitherto recognized,—furnished, however, with the scapula of *Balænoptera*.

Captain Atwood, a resident of a part of the peninsula of Cape Cod, Mass., who is a good observer of the life of the ocean, thus writes of the scrag whale in J. A. Allen's Catalogue of the Mammals of Massachusetts, in the Proc. Boston N. H. Soc. for 1868:

"Scragg.—A species of whale known by this name, and nearly allied, if not identical with the right whale, is sometimes taken here. It is the opinion of many of our whalers that they are not a distinct species, but are the young right whale that lost its mother while very young, and has grown up without parental care, which has caused a slight modification. The most prominent feature is on its dorsal ridge; near the tail there are a number of small projections or bunches, having some resemblance to the teeth of a saw. It has no dorsal fin or hump on its back."

Additional evidence of the existence of this genus has been furnished by the Smithsonian Institution. In accordance with recommendations and directions furnished by the writer, Wm. H. Dall, the enterprising director of the West Coast Scientific Exploring Expedition, originally commanded by Dr. Kennicott, sent to the Institution drawings and descriptive notes of the grey whale of the coasts of Upper and Lower California. The writer has also examined an almost complete set of whalebone, with some other portions of the same species, in the museum of the Essex Institute, at Salem, Mass. The baleen is similar in character to that of the present species, but presents specific differences. The notes of Capt. Dall indicate a long-finned, smooth-throated whale, with a flat-pointed head like a fin-back, and no dorsal fin, but a series of knobs on the posterior region of the back. That it in all respects conforms to the generic type of the Atlantic species, can be determined from the description which follows.

The Atlantic species was named from Dudley's description by the compiler, Erxleben, without his adding to our knowledge of it, *Balæna gibbosa*. I will follow Dr. Gray in adopting this name. The latter author, in his excellent Catalogue of Seals and Whales in Brit. Mus., refers it, on the basis of the same description, to *Balæna*, with doubt.

Genus AGAPHELUS Cope.

Fingers four, elongate. Cervical vertebræ? Lumbar and anterior caudal 1868.]

vertebræ longer than their greatest diameter. Dorsal fin wanting. Gular and pectoral region without folds. Scapula with well developed acromion and coracoid. Baleen narrow, short.

AGAPHELUS GIBBOSUS Cope.

Scrag Whale, Dudley, Philos. Trans. xxxiii., 250, and of The Whalers.

Balæna gibbosa Erxleben, Systema Mammalium 610 (from Dudley), and after him of Gmelin, Bonnatere, Lacepède, Virey, Gerard, Desmarest & Fischer. Gray, Catal. Brit. Mus. 1850, p. 18, and 1866, p. 90.

Agaphelus gibbosus Cope, Proc. Ac. N. Sci. Phila., 1868, 159.

Balænoptera rostrata Cope, Proc. Ac. Nat. Sci., Phila., 1867, 147.

| | Ft. | in. |
|--|-----|------|
| Total length (estimated) of young..... | 43 | |
| Length to third caudal vertebra..... | 33 | |
| Length of cranium (estimated)..... | 6 | 10 |
| " mandibular ramus (in curve)..... | 6 | |
| " pectoral limb..... | 4 | |
| Width of " "..... | | 15 |
| Length of humerus..... | | 11.5 |
| " radius and ulna..... | | 17 |
| Posterior margin of scapula..... | | 14 |
| Length of coracoid from glenoid cavity..... | | 3.3 |
| " glenoid cavity..... | | 6.3 |
| Mandible, length from condyle to coronoid..... | | 13.5 |
| " depth at coronoid..... | | 8.5 |
| " " 2.5 feet from coronoid..... | | 4.6 |

The form of the mandibular ramus is peculiar, and more like that of the *Balænoptera rostrata* than any other. It is triangular in section, having an inferior angulated ridge, and a broad, slightly convex, superior face, instead of their usual ridge. Such a ridge leaves the coronoid process, but soon turns inwards to form the inner outline. Width of the superior face 3.5 inches. The coronoid process is quite elevated, and turned outwards. In the fresh animal the lower lip included the upper all round. The laminae of whalebone are placed on a base having a sigmoid flexure. Greatest depth of the gum 1 in. 3 lines. Within each principal lamina are two supplementary laminae, the intermediate being the narrower, the inner triangular, its intermediate bristles arising from the gum. The bristles of the supplementary plates are longer and finer than those of the outer; in the latter, three series of bristles are enclosed between very thin enamel plates. All the laminae are thin, five in an inch, and split transversely straight; white cream-colored, with a purplish shade near the centre of the base. The ulna is slender, but furnished with a prominent rounded and flattened olecranon, which is prolonged into a thin cartilaginous plate, formed like the diapophysis of a vertebra, and in the plane of the ulna; this structure appears to have been ossified in the *Sibbaldius borealis* Fisch., as figured by Dubar. In the *Agaphelus gibbosus* it occasions an abrupt angulation near the basal third of the inner margin of the fin. In the scapula, the coracoid is in its plane, but the larger acromion diverges outwards.

The anterior caudal vertebrae are more elongate than the lumbosacral, less depressed, and with the centra in every way larger. All are sharply keeled on the median line below, with a concave face between the keel and the base of the diapophysis. The caudal and lumbosacral diapophyses are obspatulate, the anterior becoming narrower. The neural spines of the lumbar vertebrae are much elevated, concave above both before and behind, the zygapophysis measuring a point considerably below the middle.

| | in. |
|--|-----|
| Third (?) caudal (not perforate) length centrum..... | 7.3 |
| depth..... | 6 |
| width..... | 6.5 |

[Sept.

| | | |
|----------------|---|------|
| | height neural spine..... | 9.5 |
| | zygapophysis..... | 4.3 |
| | length diapophysis (from front base)..... | 3.3 |
| Lumbosacral 1; | length centrum..... | 7.3 |
| | depth..... | 5.3 |
| | width..... | 6.3 |
| | height neural canal..... | 2.5 |
| | width..... | 1.5 |
| | height neural spine..... | 15.3 |
| | zygapophyses..... | 5.5 |
| | length diapophysis..... | 7.5 |
| | greatest width do..... | 5.3 |
| Lumbosacral 2 | (more anterior) length centrum..... | 6.3 |
| Lumbosacral 3 | (anterior) height centrum..... | 4.3 |
| | width "..... | 6 |
| | length diapophysis..... | 7.7 |

The ear bone is much compressed, with an inferior carina, towards which the lip of dense bone is suddenly decurved. The longitudinal opening is much contracted, especially anteriorly, where the bone is pinched up into a keel, and there is no abrupt concavity of the inner lip at that point. External surface not very rugose. Total length 3 in. 2.5 lines.

The owner of the whale tried out about one-fourth of the blubber, and procured sixty-five gallons of oil, which would give about four hundred gallons for the whole; the thickness of the adipose layer would not average 4 inches, the greatest thickness was 5 inches.

This species was black above and white below, the sides lead-colored, with longitudinal shades of the darker color; fins, basal half white, terminal black.

AGAPHELUS GLAUCUS Cope, sp. nov.

The points in which this species differs from those of the genus *Balæna*, previously known, are numerous, and will no doubt be increased on a further knowledge of the animal. The head, between one-fourth and one-fifth of the total length, allies it to the shorter headed species. From the *B. australis*, the number of dorsal vertebræ, and the color and shortness of the baleen, distinguish it, and no doubt other features will be brought out when we are acquainted with the Cape species. The dorsal serration is not known to occur in any species of the genus *Balæna*, though said to be characteristic of the *A. gibbosus*, whose characters I have just given. Two *Balæna* have been described as inhabiting the north Pacific Ocean, *Balæna sieboldii* Gray,* and *Balæna cullamachi* (Chamisso).† Both have been established on figures carved by the natives of the Japanese and Aleutian Islands respectively, the former under the supervision of a naturalist, the traveller Siebold. The carving of the *B. cullamachi*, judging from the figure given by Chamisso, can but doubtfully represent any species, but which, if it exist, will rest on the following diagnosis of its describer: "Rictu amplo forma litteræ Scurvato, elasmis maximis atrocorruleis, spiraculis flexuosis in medio capite, tuberculo in apice rostri (ex imagine) pectore pinnisque pectoralibus albis dorso gibboso sexpinnato."

These are, however, true *Balæna*. A species of *Agaphelus* exists in the Kamtschatkan Seas, according to Pallas, who, however, derives his information solely from wooden models made by Aleutian Islanders. This is not sufficient basis for an introduction to the scientific system, yet Pallas indulges in applying to it the name *Balæna agamachschik*. The pectoral limb of this species is said, however, to be white, with the under side of the flukes, charac-

* Catalogue Cetaceans, 1865, 96, Fauna Japonica, Temminck & Schlegel, t. 28, 29.

† Nova Acta Acad. Caes. xii, p. 251, Tab.

ters not found in the *A. glaucus*. Dr. Gray has already (Catal. Brit. Mus.) indicated that this, if reliable, indicates a genus unknown to him.

The *Agaphelus glaucus* is the gray whale of the coasts of California. Two specimens have been examined by my friend, Wm. H. Dall, of the Scientific staff of the U. S. Russian American Telegraph Expedition, one of them near Monterey, and descriptions as complete as the state of the specimens would allow, were made. These, which were sent to the Smithsonian Institution, and placed in my hands by Prof. Baird, are quite sufficient to indicate a whale of a species hitherto unnoticed, and to render certain its future identification.

Specimen No. 1, a skeleton nearly complete.

| | Ft. |
|--|-----------|
| Length of cranium..... | 10 |
| Of dorsal vertebræ..... | 12 |
| Lumbar and caudal (except of the fluke)..... | 26 |
| ? Vertebræ of fluke..... | ? 3 |
| Total..... | 51 |

Dorsal vertebræ and ribs, thirteen; lumbar and caudal (those in the fluke cut off with it), 28. Scapula, breadth and height not very different, with a short, broad coracoid process; its head opposite first rib. Apparently only four fingers, of which the second is the longest. 145 laminæ of baleen on each side, the longest eighteen inches long; color light yellow.

Specimen No. 2, killed by the "killers," (orca); skeleton still concealed by mass of muscle, etc.

External measurements.

| | Ft. |
|---|-----------|
| Flukes to anus..... | 14½ |
| Anus to sulcus penis..... | 2 |
| Length of sulcus..... | 1½ |
| Latter to plane of flippers..... | 15 |
| Plane of flippers to end of mandible..... | 15 |
| Total..... | 48 |

The lower jaw is four inches longer than the upper; the blow-holes are entirely concealed by four dermal plicæ, which accounts for the small misty spout peculiar to the species.

| | Ft. | In. |
|---|-----|-----|
| Length of flipper and shoulder..... | 6 | |
| " mouth..... | 10 | |
| " exterior canthus of mouth..... | 1 | 6 |
| " from chin to eye..... | 10 | 4 |
| " from eye to margin of canthus..... | 6 | |
| Width of caudal flukes..... | 8 | 9 |
| Width of mouth at canthus..... | 4 | |
| From chin to blow-holes..... | 4 | 9 |
| Longest baleen..... | 14 | |

Head of humerus opposite third rib; anterior angle of scapula just anterior to first rib. On the vertebral line, for fourteen feet from the caudal flukes, is a series of 18 ridges, like the teeth of a saw, which are altogether dermal in their character. Blubber 4—8 inches thick, thickest near the jaws and on the back near the tail; yield of oil 35 bbls. Epidermis 1 inch thick, carium .75, with numerous pores. Blow-holes 2—4 inches apart. On each side of sulcus penis a mammary sulcus a few inches shorter.

Color above and below, black, with a gray bloom like a plum. This distinguishes this species from the known *Balaenæ* of the Pacific, which are more or less white on the belly and fin.

[Sept.

Specimen No. 3. A full set of baleen of one side the maxillary is in the Mus. Essex Institute, Salem, Mass. A portion of this, kindly lent me, exhibits the following characters: Compared with that of the *A. gibbosus*, it is longer and has narrower basis. The plates moderately and simply concave, while those of the latter are sigmoidal, most curved near the outer margin, in cross section. The bristles of the California species are very coarse, varying from one to three series between the enamel plates. The bristles of the *A. gibbosus* much finer, three series together. Length of the latter 8.5 inches, width at base 4.4 inches. In the *Agaphelus glaucus* Cope, 22 in. in length, width at base 6 in. In the former nearly 6 in an inch, in the latter 2½. The baleen of the *A. gibbosus* belonged to the specimen above described.

Two rough outlines accompany Capt. Dall's notes. Both represent the pectoral fin as rather elongate, not pointed, but rather broad at the extremity. A third sketch represents the inferior view, and in it we see two lines for grooves, one on each side the median gular line. This feature, if existing, is interesting, as indicating a tendency to the plicæ of the fin back whales.

This species has usually one calf at a birth, but one was recently taken at San Diego with two fetuses. Penis 27 in. long, smooth, coarsely papillose, slightly bifid at tip, where the urethra is about the size of a goose quill. (Dall's m. s.)

Oct. 6th.

The President, DR. HAYS, in the Chair.

Thirty-five members present.

The following paper was presented for publication:

Notice of some American Leeches. By Joseph Leidy, M. D.

Oct. 13th.

MR. CASSIN, Vice-President, in the Chair.

Thirty-four members present.

The following papers were presented for publication:

Notice of some Remains of Extinct Vertebrata. By Joseph Leidy, M. D.

On the Origin of Genera. By Edward D. Cope.

On some Cretaceous Reptilia. By Edward D. Cope.

On variations in *Taxodium*. By Thomas Meehan.

Oct. 20th.

The President, DR. HAYS, in the Chair.

Thirty-six members present.

Dr. F. A. Genth made some observations on the occurrence of cupriferous ores in Texas.

Dr. A. R. Roessler, Geologist at the U. S. General Land Office at Washington, had sent him for examination a specimen from Weatherford, Archer Co., Texas. It was a piece of copperglance, containing 55.44 per cent. of copper, pseudomorphous after wood or a vegetable substance. It resembled so much similar pseudomorphs found in the Permian formation at Frankenberg in Hesse, and 1868.]

elsewhere in Europe, that he pointed out the probability of its occurring also in the Permian formation, and requested Dr. Roessler to obtain fuller details with reference to its occurrence. A few days ago Dr. Roessler received an answer to his inquiries from the General Land Office agent in Texas, with more specimens, and the following report, which he sent to me:

"After traversing the cretaceous and carboniferous series northward of Weatherford, Archer Co., Texas, I was agreeably surprised by a grand panorama of the Permian formation. This system is extensively developed in Russia between the Oural Mountains and the River Volga, in the north of England, and in Germany, where it is mined for its treasures of copper, silver, nickel and cobalt ores. It has not heretofore been known to exist in this State, or it had been mistaken for the Triassic system, which is overlying the former to the south-east. Its hills, which have been traced throughout Archer and Wichita Counties, resemble in shape the copper-bearing or gossan-crested upheavals in Ducktown, Tenn., but they are of a different age and composition. They are nearly barren, and, towering above the most beautiful mesquit prairies fringed by the finely-timbered bottoms of the tributaries of Red River, are exceedingly picturesque. The members of the Wichita System, as far as open to ocular inspection by out-crops or cross-cuts, making allowance for climatic differences, correspond closely with the lower strata, discovered at Perm and Mansfield, but its mineral resources are evidently more promising. Such numerous veins of copper ore have been traced over the summits and sides of the hills, that hardly a hundred and sixty acre tract could be found without ore on the surface. The ore crops out, as, for instance, on the Isbell Douglass Ball, in such quantity and quality that the mere collection of it, without mining, would prove remunerative. It is supposed that those veins are contemporaneous with injections at different ages of quartz, trap and porphyry. The vein lodes are parallel with the strata, but there is sufficient evidence that they partake of the nature of true veins. Cupriferous and ferruginous cross-courses, feeders and leads of manganese are often met with. A cross-cut was made to a depth of about fifteen feet upon the Isbell lode, and ten hours work resulted in the raising of 6000 pounds of copper ore. This ore is far superior to the ferro-sulphuret of copper, or copper pyrites, which ore is most generally worked in England, and it is, in fact, more profitable than the native copper as found at Lake Superior. It is easily smelted, and the strata in which it is found can also be more economically excavated than any other in which copper ores occur."

Dr. Le Conte, in continuation, spoke of the occurrence of calamite tinged with copper in the Permian formation of Southern Mexico.

Mr. Gabb mentioned the deposits of grey copper near the Colorado River, in Arizona, scattered over the surface, the debris of metallic veins.

Dr. Leidy remarked, that shad had been brought to our markets, for several years past, during the late autumnal months, which were caught in salt water, perhaps in Delaware Bay or off the Jersey coast. When the shad ascend the river to spawn, their stomachs and intestines appear to contain so little that the question is often asked as to the nature of their food. A shad which Dr. L. had purchased a few days since, on examination, was found to have the stomach full of small fishes. There were 30 of them, from 2 to 4 inches long, and all one species, which appears to be the Sand-launce, *Ammodytes Americanus*.

Oct. 27th.

MR. VAUX, Vice-President, in the Chair.

Twenty-six members present.

Philip S. Wales, M. D., was elected a member.

[Oct.

The following gentlemen were elected correspondents: L. E. Latemer, M. D., of New York; A. A. Breneman, of Lancaster; H. Evan Rijgersma, of St. Martin's, W. I.; Prof. Oliver W. Holmes, of Boston.

On favorable report of the Committees, the following papers were ordered to be published:

Notice of some American LEECHES.

BY JOSEPH LEIDY, M. D.

Having been invited by Mr. R. H. Lamborn, Secretary and Treasurer of the Mississippi and Lake Superior Railroad Company, to join an excursion to Minnesota and Lake Superior, the last summer, during the trip I had the opportunity of making many interesting observations in natural history. The many lakes of Minnesota are rich in mollusca, annelides, &c. Among the annelides, besides an abundance of the ordinary American medicinal leech *Hirudo decora*, I noticed one which struck me from its general resemblance to a variety of the European medicinal leech, *H. medicinalis*. One of the gentlemen in company with us, Mr. Clark, allowed me to try upon him its disposition to bite, but I did not succeed in getting the animal to do so. Upon examination of the leech, I find it belongs to a different genus from *Hirudo*, apparently to the genus *Aulastomum*. Its characters are as follows:

AULASTOMUM LACUSTRIS, n. s.

Body cylindroid, compressed, narrowing anteriorly, obtuse at the sides (in movement more cylindroid, or less flattened, and quite obtuse laterally compared with *Hirudo decora* in the same condition). Color throughout olive green, (with more of a yellowish hue than in the dorsal green of *H. decora*), closely maculated everywhere with confluent spots of a darker hue of the same color. Ninety-two annuli, exclusive of the lips, of uniform width, smooth. Upper lip half ovate, obtuse; lower lip narrow. Eyes ten; eight in the upper lip; the last pair separated by an annulus from the others. Mouth obliquely terminal, large. Acetabulum subbasilar, ventral, sessile, circular. Anus dorsal, above the acetabulum. Male aperture in the 24th annulus (but apparently between the 23d and 24th). Female aperture in the 29th annulus (apparently between 28th and 29th). Oesophagus capacious, extending to about the 22d annulus, with 12 folds. Jaws three, small, when at rest included in pouches formed by an eversion of the mucus membrane. Teeth 12 in number to each jaw, bilobed at base. Length 4 to 5 inches, breadth 5 lines posteriorly; acetabulum 2 lines in diameter.

Var. An individual of lighter olive green than the former had black maculae replacing the dark green ones, which were also more distinct and fewer.

Specimens described from Twin Lake, Minnesota. In the summer of 1865 I saw several leeches at Saut St. Marie, in Lake Superior, which so far as I can remember were of the same species. At the edge of the shore I also saw some cocoons which I supposed to belong to the same animal. They were ochreous yellow, oval, about 4 or 5 lines in diameter; the surface impressed with concave pentagonal and hexagonal pits. From the angles of the margins of the latter projected branching processes curling at the ends.

Notwithstanding our familiarity with the American medicinal leech, its long and frequent employment in the medical profession, and the vast numbers which have been brought to notice, it has been so imperfectly described that, in the excellent *Systema Helminthum* of my late esteemed friend Dr. Diesing, of Vienna, it has been placed with the "Bdellidea species genere penitus dubia." I therefore take the present opportunity of indicating its characters more fully. It agrees most nearly with the diagnosis of the genus *Hirudo*, of 1868.]

which the *H. medicinalis* of Europe is the type, but nevertheless possesses peculiarities perhaps rather more than specific. Its characters, generic and specific, are as follows:

HIRUDO DECORA.

Say: Long's Expedit. vol. ii, 1842, Append. 268. Moquin-Tandon: Monog. Hirud. 1846, 344. Diesing: Syst. Helm. i, 1850, 474. Wood and Bache: United States Dispensatory.

Body elongated, compressed cylindroid, narrowing anteriorly, laterally subacute; in motion convex above, flat below, with the margins compressed, thin, acute and somewhat wavy; composed of from 90 to 94 annuli, which are uniform and smooth. Head continuous with the body. Mouth obliquely terminal, bilabiate; the upper lip prominent, semiovate, obtuse, or from contraction of the tip emarginate; lower lip forming the inferior portion of the first annulus; the lips together acting as an acetabulum ovoid or obcordate in form. Eyes 10, arranged in horse shoe form, the anterior 8 above the upper lip, the posterior pair separated from the others by the first annulus. Acetabulum subbasilar, ventral, sessile, circular. Anus dorsal, above the acetabulum. Male aperture perforating the 25th annulus, with the lips more or less prominent. Female aperture between the 29th and 30th annuli. A group of four papillæ situated back of the latter on the 34th to the 36th annuli inclusive. Jaws three, semicircular, laterally compressed, furnished with 55 teeth, which have an acute curved summit and an expanded bilobed base. Oesophagus short and narrow compared with that of *Aulastomum*, furnished with 6 longitudinal folds, of which three coarse ones descend from the jaws and three narrow ones are intermediate.

Color. Dorsal surface olive green, with a median irregular band and a lateral line of darker hue of the same kind; a median row of reddish brown dots, and a lateral row of black dots. Ventral surface reddish brown, extending slightly above the lateral margin, devoid of spots, or more or less maculated with black. Acetabulum colored like the back above and the belly below.

In the genus *Hirudo*, as characterized by Diesing, (Syst. Helm. i, 465), and to which he assigns 9 recognized species, the jaws are furnished with from 60 to 70 teeth, and the male aperture is situated between the 24th and 25th segments. Moquin Tandon (Monog. Hirud. 1846, 326) likewise assigns the latter as the position of the male aperture in the genus *Hirudo*.

The position of the generative apertures in *H. decora* often appear more or less discolored, or of a dull purplish hue, and the same is the case with the group of papillæ back of them. The latter do not exist in the medicinal leech of Europe. They are quite conspicuous in ours. I have suspected that they were provided for the adherence of individuals in sexual intercourse, and this view is confirmed by Mr. S. J. Moore, the well known professional leecher and bleeder of this city. Mr. Moore informs me that in copulo two individuals adhere in the position of the papillæ and make two turns of a spiral upon each other.

The red and black spots of the back contain from 20 to 22 in each row.

Length up to 7 inches, by 8 lines in breadth posteriorly; and the acetabulum 3 lines in diameter.

Notice of some remains of Extinct PACHYDERMS.

BY JOSEPH LEIDY, M. D.

DICOTYLES NASUTUS.

Extinct Peccary. Leidy: Pr. A. N. S. 1860, 416.

An extinct species of Peccary, obviously different from any one heretofore noticed, is indicated by a specimen submitted to my examination by the late Dr. David D. Owen. It was found in digging a well in Gibson Co., Indiana, at a depth of between 30 and 40 feet.

[Oct.

The specimen consists of the fore part of the snout, containing on one side of the jaw the upper canine and anterior two molar teeth. It belonged to a species larger than any of those previously noticed. The face in advance of the molars was more prolonged proportionately than in other species, but was also proportionately narrower.

The two premolars retained in the fossil are blunted from wear, but are clearly constructed after the same pattern as those of the living Peccaries.

The incisors, as indicated by their alveoli, held the same relative position as in the latter, but appear to have been comparatively feeble organs, and the anterior pair were but slightly larger than the lateral ones.

The upper canine has the same form and mode of insertion as in the recent Peccaries, but is proportionately smaller.

The anterior ends of the coössified premaxillaries project to a much greater degree in advance of the incisors than in the other known Peccaries. They are also more truncate in appearance; and on each side of the intermaxillary notch they exhibit a conspicuous pit, apparently for the attachment of a pair of muscles intended for a longer and more mobile snout than is possessed by the living Peccaries.

The measurements of the fossil compared with those of other Peccaries, are as follows:

| | <i>D. nasutus</i> , | <i>compressus</i> , | <i>labiatus</i> , | <i>torquatus</i> . |
|---|---------------------|---------------------|-------------------|--------------------|
| First molar to front of premaxillaries, | 58 lines. | 46 lines. | 41 lines. | 31 lines. |
| " " to canine alveolus, | 30 " | 23 " | 14 " | 8 " |
| Length of jaw in advance of canines, | 24 " | 19 " | 20 " | 17 " |
| Breadth outside of canine alveoli, | 28 " | 29 " | 31 " | 26 " |
| Ant. post. diam. first premolar, | 4½ " | 4½ " | 5 " | 4½ " |
| " " " second " | 5½ " | 5 " | 5 " | 4½ " |
| " " " base of canine, | 5½ " | 6½ " | 8 " | 6 " |

Mr. Timothy Conrad has recently submitted to my inspection the crown of a second molar tooth obtained by Dr. P. Knieskern, from a miocene formation of Shark River, Monmouth Co., New Jersey.

The tooth bears nearly the proper relation of size with the premolars in the specimen above described of *D. nasutus* to belong to the same animal, but the fact of its being found in a miocene deposit, while the latter is of supposed post-pliocene age, renders it probable that it pertains to a different species.

The crown has a strong basal ridge, hardly interrupted at the most prominent portion of the lobes externally and internally. The lobes present the same form and relative position as in *D. labiatus*. They are considerably worn, exhibiting on their summits exposed tracts of dentine; nearly circular on there external, and larger and irregularly reniform on there internal. The measurements of the tooth in comparison with the corresponding tooth of other species are as follows:

| | | |
|------------------------|----------------------------|------------------|
| Fossil tooth, | ant. post. diam. 9½ lines, | trans. 8½ lines. |
| <i>D. labiatus</i> , | " " 7 " | " 6½ " |
| <i>D. torquatus</i> , | " " 6½ " | " 6½ " |
| <i>D. compressus</i> , | " " 7½ " | " 6½ " |

ANCHIPPUS TEXANUS.

An apparent solipedal pachyderm, allied to *Anchitherium*, is indicated by a specimen consisting of the greater and more characteristic portion of an upper molar tooth submitted to my examination by Dr. B. F. Shumard. It was obtained from "Hutchen's well," from a yellow sandstone, supposed to be of miocene age, at a depth of 50 feet below the surface, in Washington Co., Texas.

The size of the tooth, as well as the general form and proportions, have been nearly as in the European *Anchitherium aurelianense*. Six lobes, as in the latter, enter into the constitution of the crown. The external lobes, imperfect, appear

1868.]

to have had the same form as in *Anchitherium*. The inner lobes also have the same form but are proportionately less robust, while the median lobes are more so. The postero-median lobe pursues the same course as in *Anchitherium* and likewise, as in this, joins the outer lobes at their conjunction. From near the middle of its course it gives off a process directed towards the interval of the antero-internal and antero-median lobes and ceasing short of them. This process looks as if disposed to join the contiguous portion of the antero-median lobe, together with it to form a crescentoid lobe, embracing the antero-external one, as in the corresponding columns of equine teeth. No such arrangement exists in *Anchitherium*. A triangular tubercle, as in the latter genus, occupies the space at the back of the crown, and it appears as if its anterior angle had a disposition to join the contiguous portion of the postero-median lobe, to form with it a crescentoid lobe, in like manner as in the former case, to embrace the postero-external lobe.

The construction of the tooth clearly indicates an animal of intermediate character to *Anchitherium* and *Equus*.

ANCHIPPODUS RIPARIUS.

Mr. Timothy Conrad has submitted to my examination the specimen of a tooth of rather enigmatical character, which I suspect to indicate a *pachyderm* at least with solipedal affinities. It was obtained by Dr. Kniessern from a tertiary formation, either eocene or miocene, of Shark River, Monmouth Co., New Jersey.

The tooth would appear to correspond with a first or second lower true molar of a ruminant, or with any of the series between the first and last molars in *Paleotherium* or *Anchitherium*. The crown is much worn, even so as to obliterate some of its distinctive features. It is composed of a pair of demi-conoidal lobes, one before the other, the plane side internally, the convex and sloping side externally. From each lobe descends a fang in the usual manner. No fold, and only a feeble basal tubercle occupies the deep external angular interval between the lobes. The worn triturating surface presents, on the anterior lobe, a wide crescentoid tract of exposed dentine, slightly concave and bordered with thick enamel. The anterior arm of the crescent is obtuse; the posterior extends less inwardly and is acute. The posterior lobe exhibits a half ellipsoidal tract of dentine, nearly straight at its inner margin, and bordered with enamel, except behind, where it has all disappeared. The dentinal tracts of the two lobes are separated by a narrow isthmus. The enamel is thick, black and shining, and though it appears to have originally been more or less rough, yet it is now nearly smooth. The measurements of the specimen in its present condition are as follows:

Fore and aft diameter of the crown 10 lines; breadth of posterior lobe obliquely at base of the enameled crown $9\frac{1}{2}$ lines; breadth of anterior lobe in same position $8\frac{1}{2}$ lines; breadth of worn triturating surface of posterior lobe 6 lines; breadth of do. on anterior lobe $5\frac{1}{2}$ lines.

LOPHIODON OCCIDENTALIS.

Dr. Hayden's last collection of Mauvaises Terres fossils contains a last inferior molar tooth which has all the characters ascribed to the corresponding tooth of the extinct tapiroid genus *Lophiodon* of European eocene formations.

The crown is composed of a pair of transverse hill-like lobes, as in the lower molars of the Tapir with the addition of a well developed posterior conoidal talon. The principal lobes have subacute summits slightly concave transversely, their posterior surface sloping, their anterior surface concave, and their exterior sides convex. The talon is about half the height of the principal lobes, convex behind, and with the front surface inclining from the middle on each side. The crown is bounded in front by a basal ridge. Fore and aft diameter of the crown $9\frac{1}{2}$ lines; transverse diameter in front 6 lines.

I have a suspicion that this specimen belonged to the lowest bed of the

[Oct.

White River tertiary formations, and with associated remains of *Hyopotamus* and *Titanotherium*, probably indicates the end of the eocene, which was succeeded by the more extensive miocene deposits of the Mauvaises Terres, and the pliocene deposits of the Niobrara River.

On some Cretaceous REPTILIA.

BY E. D. COPE.

NATANTIA.

CLIDASTES Cope.

This genus is established on a species represented by a single dorsal vertebra, which was found by my friend Prof. O. C. Marsh, of Yale College, in a marl pit near Swedesboro', Gloucester Co., N. J. Its form is highly characteristic, and resembles considerably that of such genera of Iguanidæ as *Euphyryne* and *Dipsosaurus*, and in some degree those of *Cyclura* and *Iguana*. It differs from the dorsals of known serpents in having a zygosphen on the plane of the anterior zygapophysis, and in having the costal articular surface continuous with and covering the diapophyses. It differs from the genera of Iguanidæ mentioned in the very small amount of upward direction which the face of the articular ball of the centrum exhibits. This face is nearly vertical, meeting the lower plane at a slightly less angle than the upper. It is much more strongly convex transversely than vertically. The neural arch rises from the anterior three-fourths of the centrum, the zygapophysis coming off from the edge of the cup, and the diapophysis from 2 of the length behind it. The zygapophysis is more prominent than the zygosphen, and the sinus between them is floored by a thin horizontal plate at its fundus.

The general form of the vertebra is depressed. The zygapophyses are spread apart, and their outer margin continues in a straight line from the diapophyses. The diapophyses are directed upwards, and are vertical compressed in form; they are opposite to about equal portions of the centrum and neural arch. Their posterior face is slightly concave, and the upper face behind forms, with the neural arch, a deeply concave line. The convexity of the ball is not so great as in the *Crocodylia*, and, with the thin lipped cup, resembles that of *Mosasaurus*; this resemblance is heightened by the slightly depressed upper outline of the ball, and the form of the diapophyses. The inferior face of the centrum presents a median obtuse ridge, and nearly flat lateral faces, which are concave antero-posteriorly. The cup is broader than deep, and has a slightly concave outline; the base of the zygosphen originates opposite the middle of the neural canal. The latter is a broad vertical oval.

CLIDASTES IGUANAVUS Cope, sp. nov.

In this species the articular face of the zygosphen is inclined at an angle of 45°, while that of the zygapophysis is a little more horizontal. The posterior zygapophyses are broken off.

| | In. | Lin. |
|--|-----|------|
| Length of centrum below..... | 2 | 0·5 |
| Width of cup..... | 1 | 6·8 |
| Depth "..... | 1 | 1·5 |
| Width between extremities diapophysis..... | 3 | 0·5 |
| Depth articular face diapophyses..... | | 10·5 |
| From diapophysis to end zygapophysis..... | | 9 |
| Between zygosphen and zygapophysis..... | | 4·5 |
| Width centrum anterior to ball..... | | 15 |
| Width of neural canal behind..... | | 5·5 |

While there is a probability that this animal was a forerunner of the Iguanian type of *Lacertilia*, it possessed, no doubt, strong relationships to *Mosasaurus*.]

rus. Its nearest ally is *Macrosaurus*, in some of the vertebræ of which a slight groove, beside the zygapophysis, is the rudiment of the *zygantrum*. If of the same proportions as *Iguana* and *Amblyrhynchus*, its length would not have been much different from twelve feet, or that of the largest alligators of the Mississippi.

OPHIDIA.

PALÆOPHIS Owen.

PALÆOPHIS LITTORALIS Cope. Proc. Acad. Nat. Sci. Philad. 1868, 147.

This, with the following, is the only serpent whose remains have been found in the United States in deposits older than the post-pliocene. We owe its preservation to Dr. Knieskern, of Shark River, N. J., best known by his botanical investigations. It is in possession of the New Jersey State Geological Survey, and has been submitted to me by Prof. Geo. H. Cook, the Director, for examination. The specimens consist of three vertebræ, neither of them perfect; the most so with neural arch, but with diapophyses broken off.

The more perfect is an anterior dorsal, with two hypapophyses, the anterior small and directed forwards, the posterior larger, and directed vertically downwards. The ball has some superior up-look, though the groove which bounds it is but little oblique. Centrum much compressed behind the middle. Plane of basis of zygapophysis opposite floor of neural arch; zygapophysis directed slightly upwards and outwards, continuous by a broad wing running posteriorly, with the diapophysis. Neural arch well elevated, (broken off behind). The basis of the neural spine is narrow on the anterior part of the arch, and does not reach the anterior margin.

| | |
|--|------|
| | Lin. |
| Length centrum (ball to edge cup)..... | 8.25 |
| Depth ball..... | 4.25 |
| Width "..... | 5. |
| " between extremities of zygapophyses..... | 8. |
| Depth cup and neural arch..... | 7.5 |
| Width neural arch behind..... | 2.25 |

A strong ridge extends from the zygapophysis posteriorly parallel with the centrum. There is no ridge continued from the zygosphen. Except a slight ridge below the fossa, which is above and back of the diapophysis, the surface of the vertebra is smooth.

Another vertebra is rather broader in proportion to its length, and less compressed.

| | |
|------------------------|------|
| | Lin. |
| Length (as above)..... | 7.8 |
| Width ball..... | 5 |

In both the ball has a subtriangular outline. In the more perfect, the base of the neural canal is divided by a narrow longitudinal epapophysis.

Locality.—The eocene green sand bed of Shark River, Monmouth Co., N. J.

PALÆOPHIS HALIDANUS Cope, sp. nov.

A single vertebra represents this species. It indicates one of the largest of the genus, being little different from the *P. typhæus* of Owen in size. The bulk of the vertebra is double that of the *P. littoralis*. In addition to this point, it differs from the latter in the greater transverse diameter of the cup and ball; these are transversely oval; in the *P. littoralis* subtriangular ovate; the centrum is naturally less constricted and broader in the former. The articular face of the zygapophysis is broadly ovate in the *P. halidanus*, narrowly in the smaller species; while there are indications of similar posterior hypapophysis in both, the anterior in the *P. halidanus* appears to have been smaller.

As compared with the species described by Owen, the cup and ball are more

[Oct.

transverse than in any noticed in the British Fossil Reptiles. approaching that figured by him in pl. 3, fig. 22-4; the ball has not the oblique, up-looking profile of that species, but forms a nearly regular arc, with its posterior margin superiorly a little behind its position inferiorly. The hypapophysial ridge is considerably interrupted, as in the *P. typhæus*, while *P. littoralis* agrees with the *P. toliapicus* in having it continuous. The two last named species differ in the development of their hypapophyses; in the American species both are large, especially the posterior; in the English, the anterior process is weak or wanting; the ridge connecting the zygapophyses disappears in the *P. toliapicus* and continues in the *P. littoralis*. The general proportions of the centrum are slender, as in *P. toliapicus*, and not so stout as in *P. porcatius* Owen.

The diapophyses in the *P. halidanus* are not so pedunculate as in *P. typhæus*, though they are separated above by a notch from the vertical ala which descends from the zygapophysis, which I do not find in the *P. littoralis*. They approach near the margin of the cup in their transverse extent below.

The horizontal ridge between the zygapophyses is strongly marked, and in the specimen in hand comes off from the anterior vertical ala below the zygapophysis, rather than from the plane of that process, as in *P. littoralis*. The neural canal is depressed behind, below the margin of the ball, and has an obtuse epapophysis along the median region of its median line. There is no ridge parallel to the hypapophysis. The cup is partially broken, but its transverse diameter appears to have been one-fourth greater than the vertical. The transverse plane of the face of the zygapophysis is transverse. A large part of the neural arch is broken away.

| | Lines. |
|---|--------|
| Length from edge up to convexity of ball..... | 12·75 |
| Width between anterior zygapophyses..... | 13·5 |
| “ of cup..... | 8·4 |
| Depth “..... | 6·2 |
| Least width centrum at middle..... | 5·3 |
| Width neural canal..... | 4· |

Locality.—This serpent was found by my friend O. B. Kinney in the excavations of the Squankum Marl Company, at Squankum, Monmouth Co., N. J., a few miles south of Shark River. The horizon is eocene.

This animal was probably a sea-serpent distantly allied to the Boas, and far exceeding in dimensions those at present inhabiting the Indian Ocean. Its size was similar to that of the very largest of terrestrial serpents of the modern era, and was probably proportioned to a length of twenty feet.

CHELONIA.

ADOCUS Cope.

Emydoid tortoises, in which the rib-heads of the posterior costal bones are represented by rudimental laminae, and the anterior by a crest or truncate ridge in addition. Vertebral scuta narrow; external surfaces smooth or nearly so.

Name from *A*, and *Adocus*, raster (*i. e.*, rib-head).

This genus, now first characterized, differs from Emys in the absence of costal capitula of the costal plates of the carapace, a feature pointed out by Leidy in the type species. It also possesses a character of Pleurosternum in the presence of a series of marginal dermal plates on the sternal bridge. It belongs to the true Emydidae, having the eight paired sternal bones instead of ten of the first-mentioned. The markings of the dermal plates of the plastron are not distinct. Besides the species here described, it includes *A. beatus* (Emys Leidy), *A. firmus* (Emys Leidy), *A. pravus* (Emys Leidy), and *A. agilis* Cope. It represents Emys in our cretaceous, as Osteopygis Cope does Chelydra, and Taphrosphys Cope (type *Platemys sulcatus* Leidy) does Hydraspis.

1868.]

ADOCUS PETROSUS Cope.

This species is represented by portions of four costal bones, parts or wholes of six marginal bones, most of the right hyosternal, and a posterior portion of the right hyposternal, with the head of the os coracoideum. They were found in the West Jersey Marl Company's pits, Gloucester Co., N. J., in the same locality whence the *Laelaps* was procured.

The hyosternal bone is preserved in its axillary margin, and is continuous with two marginals of the carapace of the same side. Two of the costals are adjacent, and give the outlines of the vertebral bones and scutes. These show the inferior outline to be very convex, the whole, from angle to angle of the marginal bones of opposite sides, amounting to an arc of about 124 degrees. Each hyosternal is slightly concave below the plane of their common suture. Each thins out laterally, though the one preserved is very thick on the axillary margin. There is little difference between the thickness at the mesosternal and hyposternal sutures. All the sutures have minute rugosities, differing much from sternals in *A. agilis* and *Taphrosphys*, which are very ragged, and resembling those of *Pleurosternum pectorale* m. The piece of hyposternal is even thicker than the hyosternal. The bone is everywhere remarkable for the thickness of its dense layer, and the closeness of the texture of the spongy. The former is one-third the thickness of the sternal and costal bones fractured.

The scute sutures of the inferior surface are obsolete; those of the dorsal surface are like those of *Adocus*, i. e., the vertebrae with bracket-shaped lateral borders, with the costal proceeding from the point of the bracket.

The marginal bones vary much in thickness proximally. They have two proximal sutures, one side convex, the other concave. Four have a heavy border, round in section; in two of these it is considerably everted. Another has a rather thin margin, slightly decurved, with a submarginal groove separating it from the most massive portion. The costal bones are strongly convex in their length, indicating an arched carapace.

Measurements.

| | In. | Lin. |
|---|-----|------|
| Hyosternal width..... | 3 | 9 |
| “ “ to origin axillary abutment..... | 2 | 1.5 |
| “ length on median suture..... | 2 | 1.5 |
| “ thickness near mesosternal line | | 9 |
| “ “ “ hyposternal “ | | 7.2 |
| Hyposternal thickness near posterior suture | | 9 |
| Costal width..... | 1 | 7.5 |
| “ thickness vertebral suture..... | | 8 |
| Marginal No. 1 width..... | 2 | 1.5 |
| “ “ length..... | 1 | 7 |
| “ “ proximal thickness..... | | 3 |
| “ No. 5 “ “ | | 8.2 |
| “ “ length..... | 1 | 6 |
| “ “ width..... | 1 | 7.5 |
| “ width dermal scute..... | | 9 |

This animal is therefore a species of considerable size, though less than most of those described here, and particularly convex and solid in every part. While the sutural lines of the hyosternal measure about the same as in *A. firmus* (Emys Leidy), it is much more convex and not so thick at the mesosternal suture. The marginal bones are relatively just half the size. The *Pleurosternum pectorale* differs in being very much flatter, and in having a more discoid mesosternal bone. The hyosternals are also much thicker at their union with the marginals than in the present.

A portion of a hyo- or hyposternal bone collected at the same place, and near or at the same time, may be referred to a larger individual of the same

[Oct.

species or to *A. firmus*. It exhibits a wedge for a diagonal gomphosis between the two sutures, which are preserved. The thickness on the median suture is 14 lines.

DINOSAURIA.

LÆLAPS Cope.

LÆLAPS AQUILINGUIS Cope.

External form and position in Lælaps.

The short fore-limbs of this genus suggest at once the habit of standing upon the hind limbs chiefly, yet this disproportion is no sufficient reason therefor, and is seen to exist in the tailless *Batrachia*, where no such position is assumed. It exists to a less degree among the modern lizards, whose position we well know to be always horizontal.

Lælaps had, however, no doubt an erect position, for the following reason: The head and neck of the femur are at right angles to the direction of motion on the condyles, or in the same plane as the transverse direction of the condyles. This indicates that the femur has been reflexed and extended in a plane parallel with that of the vertebral column. The relations of articulation are those of birds, and different from those of reptiles, where the directions of the proximal and distal condyles of the femur are oblique to each other, and the proximal of a vertically elongate form, thus allowing the femur to be obliquely directed as regards the axis of the body, so that in a prone position it rested on the ground equally clear of the body and the flexed tibia.

The resemblance of the tibia, with its high crest and embracing astragalus, as well as the slender fibula, to those of the birds, confirms this position; so do types of the iliac and sacral structures. The same is suggested by the great bird-like reptile tracks found in many places.

How must a reptilian form with elongate vertebral column and heavy tooth-bearing cranium have stood erect? The elongate form of the femur as compared with the tibia is only seen among animals who walk erect, in man; in the birds and kangaroos the femur is very much shorter than the tibia; besides these no other vertebrates progress on the hind limbs entirely. The lizards, which are prone, present the long femur exceeding or equalling the tibia.

The bird-like reptile did not, however, exhibit the slight flexure between femur and tibia presented by man. The acetabulum in the known Dinosaurs is not or but weakly completed below, or what would be in man anteriorly, indicating that the weight of the body was supported by a femur placed at a strong angle with the longitudinal axis of the ilium; otherwise the head of the femur would be most readily displaced. If, therefore, the ilium were more or less erect, the femur was directed forwards; if horizontal, the femur must have projected downwards. I have shown, however, that the position and therefore the ilium was oblique or erect; therefore the femur was directed very much forwards.*

There are, however, other reasons for believing that the femur was directed forwards, and somewhat upwards from the ilium. One is, that the centre of gravity of an elongate reptilian dorsal and sternal region must have been further forwards than in the short-bodied bird, and therefore the knee must have been further forward, in order to bring the support—i. e., the tibia, etc.—beneath it. Another is, that the articulation of the tarso-metatarsal bones with

* The remarks of Prof. Owen on this relation in *Megalosaurus* are so pertinent, that they are introduced here:

"The backward position and production of the corresponding articular prominences or condyles in both femur and tibia, indicate that these bones were joined together at an angle, probably approaching a right one, when in their intermediate state between flex on and extension; and that the motion of the tibia could not have taken place to the extent required to bring the two bones to the same line."

the tibia is excessively oblique, requiring that one or both sections of the limb should be very oblique to the vertical line. As the tarso-metatarsal elements support the weight immediately on the ground, and as it is obvious that the leverage moving the great weight of the body on its support must have been the gastrocnemius and soleus muscles extending the tibia on the metatarsal segment as the fixed point, and as there is no indication of correspondingly powerful muscles to flex the metatarsals on the phalanges, it is obvious that the latter has been the more vertical, and the former the more oblique segment. And if the tibial segment has been oblique, for reasons just given, the femur must have been oblique also.*

The length of the femur has had relation to another peculiarity as well, as follows:

In an animal designed to walk erect, it is necessary that the centre of gravity should be transferred as far posteriorly as is consistent with the type. In *Lalaps* and other Dinosauria we have very elongate pubic and iliac bones, and, as I have before described, these appear to have been designed to enclose and support an abdominal mass, in a position beneath the sacrum, and posterior to the position observed in quadrupedal mammals and reptiles. We would thus have a prominent keeled belly between the femora, supported by elongate curved ischia behind, and slender pubes directed downwards in front. In *Pœcilocentrum* the space between the latter and the sternum was occupied by abdominal ribs. The length of femur places the arc through which the knee moves beyond this projection.

The confluence of a greater number of vertebrae to form a sacrum, seen in this order and in the birds, would seem to have a direct relation to the support of the above-mentioned greater weight by it, than in horizontal vertebrata, where the weight is distributed throughout the length of the vertebral column.

The shifting of the neural arches backwards, seen in the same orders, pointed out by Owen, would have a mechanical relation to the same necessity,—i. e., their partial transfer over the intervertebral spaces naturally tending to strengthen the union of the sacral elements.

The foot need not, however, have been placed precisely beneath the centre of gravity of the body, as the animal was furnished with a tail of greater or less weight. This member bears, however, little proportion to the great size of those seen in *Iguanodon*, *Hadrosaurus*, etc., but exhibits a commencement of the reduction which is so striking among the birds.

The proportions of the metatarsus are only to be ascertained by an examination of those of allied species, as *L. macropus* and *Megalosaurus bucklandii*. As all the other bones are more slender than those of the latter, so were no doubt these bones longer in proportion to their breadth. I have estimated it above as equal to a little over half the tibia.

The digits in the genus *Lalaps* have not, in all probability, been more than four. The less bird-like forms of *Hylæosaurus* and *Iguanodon* have had, according to Owen, but three metatarsals, and it is not according to the *rule of successional relation* that there should be any repetition of a reptilian character, in a point of prime importance in measuring the steps of succession between reptiles and birds. *Lalaps*, and probably *Megalosaurus* also, had but three digits directed anteriorly, and a fourth lateral or rudimental.

It is true that Deslongchamps ascribes five digits to *Pœcilocentrum*, after a careful study of abundant material. He was, however, much more impressed with the Crocodilian affinities of that reptile than with any other, and did not recognize the avine in the astragalus. It seems to me quite possible that one of his toes can be dispensed with,—for example, the second, of which but one phalange is said to remain. If we ascribe the fractured extremity of the bone

* Probably in a squatting posture the animal rested on the entire sole as far as the heel, though not under ordinary circumstances; as I have suggested in *Amer. Naturalist*, i, 28. Mycæria and other wading birds assume a similar position at times.

regarded (Tab. viii, fig. 6) as the first phalange of the fourth digit, to the metatarsal of the same, the phalange referred to the second may find another place. The fifth digit also rests on the evidence of one phalange only. Though the reasoning of Deslongchamps in referring these pieces is good, it seems to me that renewed study might result in ascribing to this genus three toes anteriorly and one appendicular,—his first.

The predominance of Reptilian characters in the Dinosauria, as indicated by the structure of the vertebræ and other points, renders it probable that the vertebral column did not present that remarkable flexure where the cervical and dorsal series are joined, which is seen in the birds, but rather that they were more or less continuous, and formed a continuum from the sacrum to the nape. The cervicals may have been somewhat elongated, as in some birds, yet this is not probable in view of the necessary balance to be preserved, which would not admit of much projection of the cranium anteriorly. The cervicals of *Hadrosaurus* are not so long as in the modern *Varani*; in *Iguanodon* they are similar, while their rather oblique articular faces indicate the elevation of that region, and of the position of the cranium. In the case of these animals, there is not the same necessity for a long neck as in the birds, for even in *Lælaps* and other genera which probably never used the fore limbs in progression, they furnished a support to the body when the head was employed in taking food, etc., on the ground.

The caudal region affects the general proportions of a vertebrated animal materially. In *Lælaps* it is shorter than in any known Dinosaur, measuring less than the hind limb by half a foot. It was cylindrical, slender towards the tip, and in fact not unlike that of a dog, and probably capable of motion similar to the latter. When the *Lælaps* stood erect, the tail would trail its extremity on the ground, but could furnish little support.

Comparison with other Dinosauria.

The species with which detailed comparisons can be made, are the *Pœcilepleurum bucklandii* Deslongchamps, and *Megalosaurus bucklandii* Mantell. All three were of nearly similar size. The *Pœcilepleurum* is better known than the *Megalosaurus*, and furnishes many similar parts. Thus the humeri possess the same disproportionately small size, the extremity of the tibia is similarly expanded and flattened, and is similarly embraced by the astragalus. There are, however, abundant specific differences in all the bones described by Deslongchamps. In the same manner the *Lælaps aquilunguis* presents abundant specific differences from the *Megalosaurus bucklandii*. The slender curved femur differs from the massive straight one of the latter; the tibia is more slender, and more flattened distally; its extremity is wedge-shaped, not rhombic as in the European species. The claws of *Megalosaurus* are relatively shorter and less curved.

The generic relations with these two types must be understood. *Lælaps* is obviously distinct from *Pœcilepleurum* in the structure of its feet. In the former the phalanges are slender, in the latter massive, and mostly broad. The claws are more different; in the former compressed and hooked; as broad as deep in the latter, and but little curved. They are prehensile in the former, in the latter not at all, or adapted only for defense; they present a very small point of insertion, compared with the large knob of the former; they also exhibit a deep groove on the side, which is weak in *Lælaps*. The difference in this respect is about that between a raptorial and rasorial bird.

As compared with *Megalosaurus*, *Lælaps* probably had very short fore-limbs. I have pointed out the difference in the femur, which is perhaps not more than specific, though this cannot be positively asserted. The difference in the form of the extremity of the tibia I suspect also to indicate more than specific difference. The bone described by Owen (Palæontographical Society) as scapula, furnishes means of estimating the size of the humerus. The glenoid cavity is

1868.]

some six inches in diameter, indicating a humerus of four times the size of that of *Laelaps* at least. The claws also of the *Megalosaurus* are intermediate between those of *Laelaps* and *Pœcilopleurum*, being less compressed and hooked than in the first.

Size.—In estimating the length of this reptile we have the lengths of the limbs and tail, and proportions of parts of the jaws to rely on. There is some reason to believe that the lengths of the hind leg and of the tail were similar. In erect animals, as the Kangaroo and Ostrich, the length of the vertebral column anterior to the sacrum about equals the length of the hind limb. In the present form the limb is increased by the greater length of the femur than in either, but is shorter than that of the bird by the abbreviation of the metatarsals. The proportions would then remain about the same as in the bird, were it not that a head larger than in that class has evidently been borne upon the cervical vertebræ, more as in the Kangaroo. It appears then that the increased length of the femur in *Laelaps* may be added to the proportions of the Kangaroo, thus giving a nearer equality between the lengths of the hind limb and the body and head together. The length would then be seventeen feet, divided as follows:

| | Ft. | In. |
|--------------------|-----|-----|
| Tail..... | 8 | 6 |
| Body and neck..... | 6 | 6 |
| Head..... | 2 | |
| Total..... | 17 | |

This is probably the size of the Barnesboro individual, which is in all probability young, as the sacral vertebræ are entirely disunited. The phalange from Mississippi, above described, is very much larger than any of the former, and may have belonged to an adult animal. In any case it indicates a gigantic reptile of twenty-three feet or more in length.

The femur of the young individual is as long as that described by Owen (*Palæontographica*) as belonging to *Megalosaurus*. As that genus was probably more bulky anteriorly than *Laelaps*, its length, as compared with the dimensions of the hind limb, is greater. If, however, it approached *Laelaps* in proportions, as is probable, the length of thirty feet assigned to it appears too great. In fact it cannot have been larger than the Mississippi, or adult *Laelaps aquilunguis*.

Thus the original estimate of the lengths of these carnivorous Dinosaurs is still further reduced. Owen accomplished part of this by estimating on the mammalian and rejecting the reptilian type; the introduction of the avine element places the proportion at about the proper point in respect to the *Goniopoda* at least.

The elevation of the head of *Laelaps* would no doubt depend more upon the pleasure of the animal, than in a more quadrupedal form. Nine feet above the ground is a probable estimate for the young one, and twelve for the adult.

Movements.—The mind will picture to itself the actions and habits of such strange monsters as the Dinosauria, and in respect to some of the genera there is considerable basis for speculation.

That monsters walking on two posterior limbs have inhabited the earth, has been familiar to all since the publication, by Hitchcock and Deane, of the histories of the great foot-tracks of the Triassic Red Sandstone of the Connecticut valley. Such tracks have been discovered by Jno. Smock, in the same formation, in New Jersey, and by Dr. Chas. Hitchcock in Pennsylvania. Prof. Hitchcock ascribed the tracks described by him to birds. Prof. Agassiz* expresses the belief that they were made by vertebrates combining characters of existing classes, perhaps of reptiles and mammals, rather than by birds. Now a carnivorous Dinosaur probably allied to *Laelaps*, as proven by a portion of

* Contrib. Nat. Hist. U. S., 1857, vol. I.

the jaw with teeth, in the Academy's Museum, the *Bathygnathus borealis* of Leidy, has left its remains in the red sandstone of Prince Edward's Island, of the same age, and we safely conclude that some of the large-clawed biped tracks of Hitchcock are those of that animal. Dr. Leidy has suspected that this would prove to be the case, as he asks* "was this animal probably not one of the bipeds which made the so-called bird tracks in the sandstone of the Connecticut valley?" This enquiry was, after an examination of the form of *Laelaps*, answered in the affirmative.† I have ascribed these tracks to reptiles allied to *Laelaps*, and Huxley believes also that they were made by *Dinosauria*.‡

The creatures which strode along the flats of the Triassic estuary have been various in species and genera, as pointed out by Hitchcock. Some were purely biped; some occasionally supported themselves on a pair of reduced forelimbs. There are impressions where these creatures have squatted on their haunches. One can well imagine the singular effect which these huge gregarious reptiles would produce, standing motionless, goblin-like, on a horizon lit by a full moon; or lying with outstretched neck and ponderous haunches basking in the noonday sun; or marching or wading slowly along the water's edge, ready for a plunge at passing fishes or swimming reptiles. But in the active pursuit of terrestrial prey did such an animal as the *Laelaps* run like the Ostrich, or leap like the Kangaroo? So far as the Triassic tracks go, there is no evidence of leapers, only runners, fell upon an exhausted quarry. Or were they only carrion eaters, tearing and devouring the dead of age and disease? Probably some were such, but the prehensile claws of *Laelaps* are like instruments for holding living prey.

Laelaps has a long femur; those great leapers the Kangaroos have a short one; the cursorial birds, however, have a similar form of femur, but they do not leap. So this form is not conclusive. The modern *Iguanas* have long femora, and they all progress by their simultaneous motion; they only leap; but man with his long femur runs only. The question then does not depend on the form of the femur.

I have suggested on a former occasion that *Laelaps* took enormous leaps and struck its prey with its hind limbs. I say, in describing it, "The small size of the fore limbs must have rendered them far less efficient as weapons than the hind feet, in an attack on such a creature as *Hadrosaurus*; hence perhaps the latter were preferred in inflicting fatal wounds. The ornithic type of sacrum elucidated by Prof. Owen suggests a resemblance in the use of the limb."

The lightness and hollowness of the bones of the *Laelaps* arrest the attention. This is especially true of the long bones of the hind limbs; those of the fore limbs have a less considerable medullary cavity. In this respect they are quite similar to those of *Colosaurus* Leidy, of which its describer remarks, "that the medullary cavity of the tibia is large, and the walls thin and dense," "being intermediate in this respect between the characters of the mammals and birds."

The mutual flexure, as well as the lightness and strength of the great femur and tibia, are altogether appropriate to great powers of leaping. The feet must have been elongate, whatever the form of the tarsi; the phalanges, or finger bones, were slender, nearly as much so relatively as those of an eagle, while the great claws in which they terminated were relatively larger and more compressed than in the birds of prey. There was no provision for the retractibility observed in the great carnivorous mammalia, but the size of the inferior basal tuberosity indicates the insertion of a great tendon of a powerful flexor muscle. The slight grooves at the base, and deeper one on each side of the phalange, suggest the usual horny sheath, which, prolonging the point of the claw, would give it a total length of eleven inches.

* Journal Acad. Nat. Sciences, 1854, 329.

† American Naturalist, 1867, 27. Hay's Medical News and Reporter, 1868.

‡ Proceedings Royal Society, London, 1868, p. Natural Science Review, 1868, 1868.]

The fore limbs must indeed have been of very little use, and it is very difficult to imagine an animal running and seizing the prey it overtakes with the hind limb. If it were not a carrion feeder it must have leaped. We are informed by Hochstetter,* that the Apteryx leaps with the utmost ease over objects two and three feet in height, that is, higher than its own head. Huxley suggests that the Compsognathus "hopped" along on its hind limbs. The bulk of Laelaps is no objection to its leaping, for the giant extinct Kangaroos, Macropus atlas and titan, found in the postpliocenes of Australia, did not fall far short of these reptiles in this respect. We may add that Laelaps had smaller allies, as L. macropus one-half, and Coelosaurus antiquus one-fourth or fifth the size, whose remains, so far as they go, indicate an identity of habit. Deslongchamps says of Pœcilopleurum bucklandii, that it "could project itself with prodigious force, as a spring which unbends itself; but this could not have been on a solid surface, since the fore limbs are too weak to resist the shock of the fall of such a heavy body." He supposed it to be marine in its habits, accustomed to battling a stormy sea. However, his objection to leaping on land is obviated by understanding that progressive movement was entirely performed by the hind limbs.

On the Origin of GENERA.

BY EDWARD D. COPE, A. M.

Introduction.—The present fragmentary essay is a portion of what other occupation has prevented the author from completing. It does not therefore amount to a complete demonstration of the points in question, but it is hoped that it may aid some in a classification of facts with a reference to their signification. When all the vast array of facts in possession of the many more learned than the writer, are so arranged, a demonstration of the origin of species may be looked for somewhere in the direction here attempted to be followed.

Conclusions of any kind will scarcely be reached, either by anatomists who neglect specific and generic characters, or secondly by systematists who in like manner neglect internal structure. Such will never perceive the system of nature.†

Analysis of the subject.

I. Relations of allied genera.

First; in adult age.

Second; in relation to their development.

α. On exact parallelism.

β. On inexact or remote parallelism.

γ. On parallelism in higher groups.

δ. On the extent of parallelisms.

II. Of retardation and acceleration in generic characters.

First; metamorphoses in adult age.

α. The developmental relations of generic and specific characters.

β. Probable cases of transition.

γ. Ascertained cases of transition.

Second; earlier metamorphoses.

δ. The origin of inexact parallelisms.

* New Zealand Amer. Transl., 181.

† It might seem incredible that either class should systematize with confidence, yet a justly esteemed author writes even at the present day, "However, there is scarcely a systematist of the present day who does not pay more or less attention to anatomical characters, in establishing the higher groups!" (The italics are our own.) As though a system was of any value which is not based on the whole structure, and as though lower groups were only visible in external characters; in a word, as though external (muco-dermal, dental, etc.) characters were not "anatomical!"

- III. Relations of higher groups.
 - α. Of homologous groups.
 - β. Of heterology.
 - γ. Of mimetic analogy.
- IV. Of natural selection.
 - α. As affecting class and ordinal characters.
 - β. As affecting family characters.
 - γ. As affecting generic characters.
 - δ. As affecting specific characters.
 - ε. On metaphysical species.
- V. Of epochal relations.

The laws which have regulated the successive creation of organic beings will be found to be of two kinds, as it appears to the writer. The first, that which has impelled matter to produce numberless ultimate types from common origins; second, that which expresses the mode or manner in which this first law has executed its course, from its commencement to its determined end, in the many cases before us.

That a descent, with modifications, has progressed from the beginning of the creation, is exceedingly probable. The best enumerations of facts and arguments in its favor are those of Darwin, as given in his various important works, *The Origin of Species*, etc. There are, however, some views respecting the laws of development on which he does not dwell, and which it is proposed here to point out.*

In the first place, it is an undoubted fact that the origin of genera is a more distinct subject from the origin of species than has been supposed.

A descent with modification involves continuous series of organic types through one or many geologic ages, and the co-existence of such parts of such various series at one time as the law of mutual adaptation may permit.

These series, as now found, are of two kinds: the uninterrupted line of specific, and the same uninterrupted line of generic characters. These are independent of each other, and have not, it appears to the writer, been developed *pari passu*. As a general law it is proposed to render highly probable that the same specific form has existed through a succession of genera, and perhaps in different epochs of geologic time.

With regard to the first law of development, as above proposed, no one has found means of discovering it, and perhaps no one ever will. It would answer such questions as this. What necessary coincidence of forces has resulted in the terminus of the series of fishes in the perches as its most specialized extreme; or, of the *Batrachia*, in the fresh-water frogs, as its ultimum; or, of the thrushes, among birds, as their highest extreme: in a word, what necessity resulted in man as the crown of the Mammalian series, instead of some other organic type? Our only answer and law for these questions must be, the will of the Creator.

The second law, of modes and means, has been represented to be that of natural selection by Darwin. This is, in brief, that the will of the animal, applied to its body, in the search for means of subsistence and protection from injuries, gradually produces those features which are evidently adaptive in their nature. That, in addition, a disposition to a general variation on the part of *species* has been met by the greater or less adaptation of the results of such variation to the varying necessities of their respective situations. That the result of such conflict has been the extinction of those types that are not adapted to their immediate or changed conditions, and the preservation of those that are.

In determining those characters of plants and animals, which constitute them what they are, we have, among others of higher import, those which constitute them species and those which constitute them genera. What we propose is: that of the latter, comparatively very few in the whole range of animals and 1868.]

plants are *adaptations* to external needs or forces,—and of the former a large proportion are of the same kind. How then could they owe their existence to a process regulated by adaptation?

Darwin is aware of these facts to some degree, but, as already said, he does not dwell on them. Where he does, he does not attempt to account for them on the principle of natural selection.

There are, it appears to us, two laws of means and modes of development. I. The law of acceleration and retardation. II. The law of natural selection.

It is my purpose to show that these propositions are distinct, and not one a part of the other: in brief, that while natural selection operates by the "preservation of the fittest," retardation and acceleration act without any reference to "fitness" at all; that instead of being controlled by fitness, it is the controller of fitness. Perhaps all the characteristics supposed to mark generalized groups from genera up (excepting, perhaps, families), to have been evolved under the first mode, combined with some intervention of the second, and that specific characters or *species* have been evolved by a combination of a lesser degree of the first with a greater degree of the second mode.

I propose to bring forward some facts and propositions in the present essay illustrative of the first mode.

I. On the relations of nearly allied genera.

First. The writer's views of the relations of genera have already been given at the close of an Essay on the Cyprinoid Fishes of Pennsylvania.* It is easy enough to define isolated genera which have few immediate affines, but among extensive series of related forms the case is different. One principle, however, pervades the conception and practice of all zoologists and botanists, which few take pains to analyse or explain. It is simply that they observe a successional relation of groups, by which they pass from one type of structure to one or several other types, and the presence or absence of the steps in this succession they regard as definitions of the genera.

It is true that the reader will often find introduced into diagnoses of genera, characters which indicate nothing of this sort. It is often necessary, indeed, to introduce characters which are not peculiar to the genus characterized, for the sake of distinguishing it from similar ones of *other series*, but this only in an imperfect state of the record. Moreover, the ability of the writer to distinguish genera being thus tested, he too often fails by introducing family and specific characters, or by indulging in an unnecessary redundancy. In general it may be said that adjacent genera of the same series differ from each other by but a single character; and generally, that the more remote differ by characters as numerous as the stages of their remove.

It is precisely as, among the inorganic elements, we pass from the electro-negative, non-oxidizing extreme of the Halogens, with Fluorine as the extreme, to the electro-positive, violently oxidizing extreme of the alkaline metals, whose extreme is potassium, by steps whose relative position is measured or determined first by these tests; and as these steps have each their included series of bodies, characterized by their successive relations on the lower level of a subordinate range of characters. This principle is distinctly admitted by many zoologists;† those who deny it generally failing to perceive it because they attempt to gauge a major scale by characters which are really the test of one or all of the subordinate or included scales. It holds true of most of the groups of organic beings; thus the class is a scale of orders, the order of tribes. I will not now say that the tribe is a scale of families, as the case is here much modified, but what is chiefly to be considered in this essay, is that the family is composed of one or several scales of genera.

* Trans. Amer. Philos. Soc., 1866, from Proc. Acad. Nat. Sci., Phil., 1869, 332.

† Prof. Bronn, in his *Classen u. Ordnungen des Thierreiches*, has everywhere a chapter on *Die aufsteigende Reihe*,—"the ascending scale."

Second. Now, the more nearly allied genera are, the more surely will these generic steps be found to fall into the direct line of the steps of the development of the highest, or that with the longest scale, the former being truly identical with the latter in generic characters. Less allied genera will offer an inexact or incomplete imitation of such identity,—some additional character being present to disturb it. Such genus belongs to another series, characterized by the disturbing feature, whose members, however, bear to each other the relation claimed above for such.

The relation of genera, which are simply steps in one and the same line of development, may be called *exact parallelism*, while that of those where one or more characters intervene in the maturity of either the lower or higher genus to destroy identity, may be called *incomplete parallelism*.

The latter relation has been dwelt on by Von Bär, Agassiz and other writers, but none have accepted the existence of *exact parallelism*, or seen its important relation to the origin of genera.

Third. That the lowest or most generalized terms or genera of a number of allied series, will stand to each other in a relation of exact parallelism. That is, if we trace each series of a number, up to its lowest or most generalized genus, the latter together will form a series, similar in kind to each of the sub-series; i. e. each genus will be identical with the undeveloped conditions of that which progresses the farthest, in respect, of course, to the characters which define it as a series.

Those characters of the skeleton which we are accustomed to call embryonic, are only so because they relate to the developmental succession witnessed in animals at the present time. Characters not so called now were probably as much so at one period now passed. Hence embryonic characters of the bony system do not, as I have often had occasion to observe, characterize the types of the highest rank, but only subordinate divisions of them. Thus the Elasmobranchs are probably repressed forms of groups of a really higher grade than the bony fishes, or Teleostei, which may be known to us. In their early presence in the geologic series we have evidence of the first beginning of a higher type.

In the same manner it has been discovered that the molecular constitution of the elementary substances do not characterize their highest or most distinct series, but rather the substances themselves within the lower group or family to which they belong. The gaseous, liquid and solid molecular conditions being characters distinguishing otherwise allied substances in the same way morphologically (we cannot say yet developmentally), as the cartilaginous, osseous and exostosed or dermosseous characters distinguish otherwise nearly allied genera.

The "family" group embraces one or many of such series. If we trace the series in several families to their simplest or most generalized terms or genera, and compare them, we will not find the relation to be one of exact parallelism in the series of the "order," so far as our present knowledge extends, but in a developmental sense, one of divergence from the commencement.

If we could know the simplest known terms or family characters of a number of groups of families, or "orders," we would probably find them to represent a series of exact parallelism, though to find such simplest terms we must go far into past periods, since the higher the group the more extensive the range of its character, and the less likely to be found unmixed with additions and extensions, in modern times.

Finally, the series of classes is in the relation of the essential characters of the same, as expressed in their now extinct, most generalized and simple representatives, also one of "exact parallelism."

a. Examples of exact parallelism.

* In generic series.

1. As an example we may take the genus *Trachycephalus* (*Batrachia Anura*). 1868.]

Nearly allied to it is the genus *Osteocephalus*, which differs in the normal exostosis of the cranium not involving the derm, as in the former. Close to this is *Scytotis*, where the fully ossified cranium is not covered by an exostosis. Next below *Scytotis* is *Hyla*, where the upper surface of the cranium is not ossified at all, but is a membranous roof over a great fontanelle. Still more imperfect is *Hylella*,* which differs from *Hyla* in the absence of vomerine teeth. Now the genus *Trachycephalus*, after losing its tail and branchiæ, possesses all the characters of the genus *Hylella* and those of *Hyla*, either at or just before the mature state of the latter, as the ethmoid bone is not always ossified in advance of the parietals. It soon, however, becomes a *Scytotis*, next an *Osteocephalus*, and finally a *Trachycephalus*. It belongs successively to these genera, for an exhaustive anatomical examination has failed to reveal any characters by which, during these stages, it could be distinguished from these genera.

Now it would be a false comparison to say that the young of *Trachycephalus* was identical with the genus *Agalychnis*, which in truth it resembles, because that genus is furnished with one other character,—the presence of a vertical pupil,—and belongs to another series in consequence, which is represented as yet, with our present imperfect knowledge,—or perhaps imperfect fauna,—by three genera only.

2. The lowest type of the near allies of our common fresh-water frogs is the genus *Ranula*, where the prefrontal bones are narrow strips on each side the ethmoid cartilage; the ethmoid cartilage itself entirely unossified above, and the vomerine teeth very few and on a small elevation. There are two species, *R. affinis* and *R. palmipes*. The other species have the ethmoid cartilage ossified above, at least beneath the extremities of the frontoparietals.

Those of the latter most like *Ranula* possess the same type of narrow prefrontals, separated by a broad area of cartilaginous ethmoid, and fasciculi of teeth. Of this type is *Rana delalandii*, and probably *R. porosissima* Steind., of the South Ethiopian region. Other species of the same type extend their vomerine patches into lines; such are *R. mascariensis*, *R. fasciata*, *R. oxyrhynchus*, *R. grayi*, and other South African species.

The prefrontals are subtriangular, and approach each other more or less in the numerous species of North America and of the Regio Palæarctica, while generally the vomerine teeth are in fascicles or very short series. In the Ethiopian *Rana fuscigula* the prefrontals unite on the median line, roofing over the ethmoid cartilage and reducing it, while the vomerine teeth are in very short lines.

In the species of the Palæotropical region, *Rana tigrina*, *R. vittigera*, *R. cyanophlyctis*, *R. grunniens*, *R. hexadactyla*, *R. corrugata*, *R. ehrenbergii*, *R. gracilis*, and the Ethiopian *R. occipitalis*, the prefrontals not only unite solidly (the suture remaining on the median line), but extend and closely fit to the fronto parietals. The vomerine series have lengthened out into series.

Now the young of the latter type of *Rana* (I take as an example the *R. tigrina*, one of the most abundant and largest of Indian frogs) presents the subtriangular prefrontals neither in contact with each other or with the fronto-parietals, and the vomerine series is much reduced; in fact, it belongs in all respects to the Palæarctic group. I have not examined younger specimens, but have no doubt they are like those of the Palæarctic; the latter, then, in their young stage, are precisely of the type of the Ethiopian *Rana*, with fasciculate teeth like the young of those of the same region with teeth in series, since the prefrontals are still more reduced, becoming linear. Finally the first stage of the Nearctic *Rana*, after losing the larval tail, is the genus *Ranula*, having linear prefrontals, minute vomerine teeth, and the ethmoid ring cartilaginous above.

These points of structure are of generic quality, but I have not regarded any

*I refer to *H. carnea* m., not having Reinhardt and Lütken's type of this genus.

group as sufficiently defined to be so regarded, except *Ranula*, as the adults of some species appear not to be constant in possessing them. Thus a very large *Rana catesbeiana* sometimes exhibits prefrontals in contact on the median line, while it is difficult to say whether *R. areolata* of North America is of the Nearctic type so much as of the Ethiopian. Nevertheless the groups are generally quite geographically restricted.

3. A similar relation exists between the genera *Hyperolius*, *Staurois* and *Heteroglossa* in respect to the prefrontal bones and the separation of the outer metatarsi, and—

4. Between *Ixalus*, *Rhacophorus* and *Polypedates* also, in reference to vomerine teeth, bifurcation of last phalange, and dermoossification of the cranium.

5. When the larvæ of certain species of *Spelerpes* possess branchiæ, they also lack one digit of the hind foot, also the maxillary, nasal and prefrontal bones, and exhibit a broad continuous palatopterygoid arch, in close contact with the parasphenoid. The proötic is separated from the exoccipital by a membranous space, and the exoccipitals themselves are not yet united above the foramen magnum. There is at the same time a series of splenial teeth. Both ceratohyals are confluent, the posterior is present, and there are but three superior hyoid arches. After they lose the branchiæ, the hinder foot, which has four toes only for a time, gradually adds another at first rudimental digit, in the Mexican species; in most North American species the fifth digit appears at an early larval stage. Five digits are finally present in all *Spelerpes*.

We have thus four combinations of the above characters, at different periods of the life history of certain (but not of all) of the species of *Spelerpes*. There exist four permanent series of species or genera, equivalent to these stages. The well-known "perennibranchiate" *Necturus* is nearly identical with the first, *Batrachoseps* with the second, the half-toed *Spelerpes* with the third, and the typical *Spelerpes* is the last.

In one character of generic value only, do I find that *Necturus* differs from the early larval *Spelerpes*. It closes the premaxillary fontanelle with which it commences, by an approximation of the premaxillary spines, but not by a sutural union, as takes place in *Amblystoma*. It thus, in this one point, advances a stage beyond the condition to which *Spelerpes* attains, though it may be a question whether such a closure without union should not be classed among the specific characters by which *N. maculatus* differs from the young of the various *Spelerpes*, as they do from each other. Characters of the latter kind are the following: in *N. maculatus* the frontals are more deeply emarginate behind; it has little or no ala on the inferior keel of the caudal vertebrae, which is prominent in *Spelerpes* larvæ.

It may be that the parallelism in the case of *Spelerpes* is inexact by one character, and that a strictly developmental one; or it may be regarded otherwise.

6. It is well known that the Cervidæ of the old world develop a basal snag of the antler (see Cuvier, Ossem. Fossiles; Gray, Catal. Brit. Mus.) at the third year; a majority of those of the New World (genera *Cariacus*, *Subulo*) never develop it except in "abnormal" cases in the most vigorous maturity of the most northern *Cariacus* (*C. virginianus*); while the South American *Subulo* retains to adult age the simple horn of the second year of *Cervus*.

Among the higher Cervidæ, *Rusa* and *Axis* never assume characters beyond an equivalent of the fourth year of *Cervus*. In *Dama* the characters are on the other hand assumed more rapidly than in *Cervus*, its third year corresponding to the fourth of the latter, and the development in after years of a broad plate of bone, with points, being substituted for the addition of the corresponding snags, thus commencing another series.

Returning to the American deer, we have *Blastocerus*, whose antlers are identical with those of the fourth year of *Cariacus*.

1868.]

Now, individuals of the genus *Cervus* of the second year do not belong to *Subulo*, because they have not as yet their mature dentition. *Rusa*, however, is identical with those *Cervi* whose dentition is complete before they gain the antlers of the fifth year. When the first trace of a snag appears on one beam of *Cariacus virginianus*, the dentition includes the full number, but there remain $\frac{1}{3}$ milk molars much worn and ready to be shed. Perhaps the snag is

developed before these are displaced. If so, the *Cariacus* is never a *Subulo*, but there can be little doubt that the young *Blastocerus* belongs to that genus before its adult characters appear.

7. Leidy states* that certain *Perissodactyle* remains containing a foot of a horse, contained the teeth of a genus, *Merychippus*, which has the permanent teeth of *Equus*, and the deciduous dentition of *Anchitherium*. He observes "the deciduous and permanent dentitions of both these genera are alike, therefore the new genus is in early life an *Anchitherium*, and later in life a true horse." This is therefore a case of exact parallelism, always providing that the *Merychippus* has not added to its immature Equine characters, others in other parts of the body, which invalidate the identity. In the latter case, it will still be an interesting example of the "inexact parallelism."

8. It is well known that the *Cephalopoda* form a number of series of remarkable regularity, the advance being in the first place in the complication of the folds of the external margins of the septa, and in the second place in the degree of involution of one or both extremities of the shell to the spiral; third, in the position of the siphon.

Alpheus Hyatt, in an important essay on this subject,† points out that the less complex forms are in many cases identical with the undeveloped conditions of the more complex. He says: "There is a direct connection between the position of a shell in the completed cycle of the life of this order, and its own development. Those shells occupying the extremes of the cycle" (in time), "the polar forms, being more embryonic than the intermediate forms.‡ The first epoch of the order is especially the era of rounded, and, in the majority of the species, of unornamented shells with simple septa; the second is the era of ornamentation, and the septa are steadily complicating; in the third the complication of the septa, the ornamentation, and the number of species, about twice that of any other epoch, all combine to make it the zenith of development in the order; the fourth is distinguishable from all the preceding as the era of retrogression in the form, and partially in the septa."

"The four periods of the individual are similarly arranged, and have comparable characteristics. As has been previously stated, the first is rounded and smooth, with simple septa; the second tuberculated, and the septa more complicated; the third was the only one in which the septa, form and ornamentation simultaneously attained the climax of individual complication; the fourth, when amounting to anything more important than the loss of a few ornaments, was marked by a retrogression of the whorl to a more tabular aspect, and by the partial degradation of the septa."

I will here quote an entirely antagonistic statement of Bronn's,§ as follows: In the development of *Lamellibranchiate molluscs* "it is not possible to estimate the successional changes of one genus by those of another, though nearly related; so diverse are the most significant relations in the manner of progress

* *Proceed. Acad. Nat. Sci.*, 1858, p. 7.

† *Memoirs Boston Soc. N. Hist.*, 1866, 183.

‡ He adds here: "Although in regard to geological sequence and structural position one of the extremes must be of higher geological rank." The "*highest*" extreme will be of higher geological rank according to the complexity of structure and length of developmental scale, whether it come at the middle or end of the history of the class in time. If, as has been the case so far as known, a decline has terminated the history of a class, its later forms are zoologically *lower* than its older ones. Hence the adjective *high* is only appropriate to types of the latter kind, when used as synonymous with *extreme*.

§ *Classen u. Ordnungen des Thierreichs*, iii, 445.

among nearest allies. Therefore embryologic indications are throughout useless in classification, and it is necessary to keep carefully separate the statements of observations on development of a given species, and not transfer such facts to the history of another species for the purpose of completing it. We cannot even range these histories in conformity with family groups." For us this statement, though no doubt largely true, is an indication of imperfection, first, of knowledge of true affinities of recent, but especially of extinct adults, and second, of imperfection of knowledge of development. The position appears to be based on negative evidence, while the opposing can and does stand on nothing but positive.

β. Examples of the inexact parallelism.

1. The genera of the Batrachian family Scaphiopodidæ form a series of steps differing a little more than as repressions or permanent primary conditions in the development of the highest.* Thus two of the genera, which are North American, maintain their tubæ eustachii and tympanum through life, while three European lose them at an early period. The three European genera also advance beyond the larval character of the American in the ossification of the basis of the xiphisternum into a broad style. Thus we have two series established, which differ only in the two characters named. Each shows its developmental steps in a similar manner, the European series extending further; thus,—

| <i>European.</i> | | <i>North American.</i> |
|---|------------|------------------------|
| 1. Temporal fossa over arched. | | |
| Cultripes. | | * * |
| Temporal roof not ossified. | | |
| 2. Fronto-parietal bones ossified, involving derm. | | |
| Pelobates. | | Scaphiopus. |
| 3. Fronto-parietals ossified, distinct from derm. | | |
| * * | (Unknown.) | * * |
| 4. Fronto parietals not ossified, distinct from derm. | | |

Didocus.

Spea.

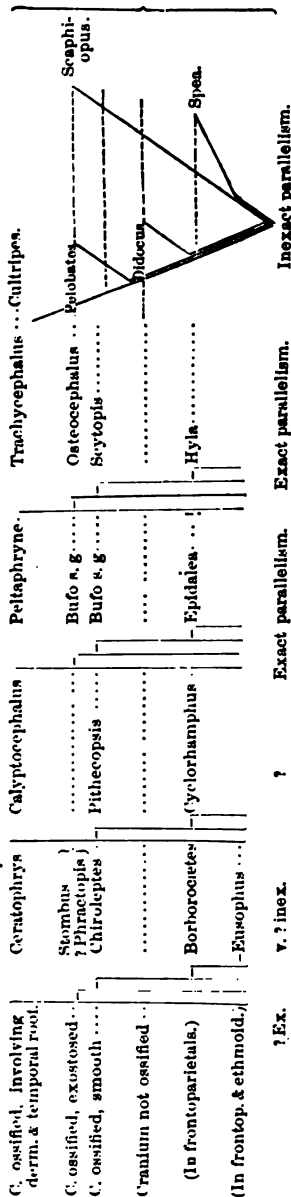
In this case *Didocus* cannot be said to be identical as a genus with an undeveloped stage of *Cultripes*, since while the cranium of the latter is in the condition of *Didocus* it bears a long tail, and the limbs are but little developed. Nor is *Didocus* identical with the undeveloped condition of *Pelobates*, since both cranium and limbs of the latter are developed before the tail is absorbed. Nor is *Pelobates* identical with the undeveloped condition of *Cultripes*, since while the cranium of the latter is that of the former, the limbs and tail are still larval. The same relations exist between the other members of the family. The genus *Scaphiopus* is not an undeveloped form of *Pelobates* as to its auditory organs, for when the latter is identical with the former in this respect, it bears otherwise entirely larval characters. Nor is *Spea* an arrested *Scaphiopus*, the relation being here precisely that between *Didocus* and *Pelobates*. *Spea* approaches more closely an arrested *Didocus* in all respects, but that when the latter possesses the auditory apparatus† of the former, it is a larva in limbs and tail, and that it loses this apparatus before reaching the other characters of *Spea*. The relations of these genera, as compared with those of the *Trachycephalus*, *Cystignathidæ* and *Bufo* series, may be represented as follows: the lines represent the developmental scale of each.

* See Journal Academy, 1866, on *Arcifera*.

† The possession of cavum tympani and tuba Eustachii in the undeveloped condition of this genus is only assumed from its close relation to *Pelobates*.

‡ According to Bruch and Tschudi in *Pelobates*. I have found traces of the eustachian diverticula in a tailed *Pelobates fuscus*, whose body measured 1 in. 4 lin., from Mus. Peabody Institute, Salem, Mass.

relations between the terms of the different series, Heterology or Remote Parallelism.



This is an example of the simplest case of inexact parallelism, as distinguished from the exact parallelism or identity. As the fauna of the present period is but a fragment, so the simple inexact is a more frequent relation than the exact, while the more complex inexact relation is still more common. The greater the inexactitude, the more frequently do such parallels occur, till we have those of the most remote character, as, for instance, the parallelism between the different stages of the development of the mammal, in the structure of the heart and of the origins of the aorta, and the existing classes of vertebrates. The relation of these facts to the origin of genera will be noted hereafter.

It will be borne in mind that in the Scaphiopodidae the generic types are identical for a long portion of their developmental history.

2. In both Perissodactylous and Artiodactylous Mammalia, certain types develop their family character of canines at the earliest appearance of dentition, others not till a comparatively late period of life (*Equus*), and the extreme genera never produce them.

3. Among Cetaceans the genus *Orca* maintains a powerful and permanent series of teeth, which is an important generic character. In *Beluga* the series is shed in old age, in *Globiocephalus*, or the Caing whales, they are shed at middle age, while in the *Balenidae*, of which the absence of teeth is an essential character, these organs are developed and absorbed *during fetal life* (*Eschricht*). Though the condition of the teeth is not of systematic value in the two named intermediate genera, it is the important feature in the history of progress to such value.

4. Among the tortoises, the *Testudinidae* rapidly extend the ribs into a carapace, which fits closely the marginal bones, while equally early in life the elements of the sternum unite together. This is also the case with most *Emydidae*; among whose genera, however, we find the transitional scale. In *Dermatemys* and *Batagur* the carapace is very late in attaining its complete ossification, while the plastron is early finished. In *Chelydra*, on the other hand, while the carapace is even more slowly developed, the plastron is never free from its larval fontanelles. In the marine turtles neither plastron or carapace is ever completed, while in the *Trionychidae* the marginal bones are also entirely undeveloped.

In order that this last illustration be a true one for the theory in question, as applied to the *families*, these developmental characters

[Oct.

should be the true distinctive features of these families respectively. This, as is well known, they are not. The Cheloniidæ are characterized by the form of their anterior limbs, which is in an adapted structure, while the Testudinidæ similarly are distinguished by an extreme opposite modification of foot-structure, adapted to an extreme difference of habit. Here there is an example of the co-working of both laws. Nevertheless, we only claim at present to show the developmental relation of *genera* of the same family and the same series. This we see among the Emydidæ.

5. In the important character of the scutellation of the tarsi among the Passerine birds, the "boot" appears early in life in the highest Oscines, later in the lower, and does not appear at all in the majority. In respect to the still more important feature of the long posterior plates which appear very early in most Oscines, in the Myiadestes type* they appear late, the squamæ remaining long, while the Clamatores never develop the plates, not advancing beyond the infantile squamous stage.

6. It has been shown by Falconer that the genera of great Proboscidiæ form a remarkably regular and graded series, distinguished by their dentition. These are Dinotherium Kaup, Trilophodon Falc.,† Mastodon Cuv., Pentalophodon Falc., Stegodon Falc., Loxodon F. Cuv., and Elephas Linn. In the first there are but two cross crests on the third molars, and a pair of permanent mandibular tusks; in the second, three cross crests and mandibular tusks only permanent in some males; in the third, four cross crests and the mandibular tusks all deciduous; in the fourth, five cross crests on the third molar; tusks unknown. In Stegodon the tusks cease to appear, the crests of the third molar become more numerous, and embrace between them, in the bottoms of the valleys, a strong deposit of cementum. In Loxodon the crests have the whole interspaces filled with cementum, while the same thing holds in Elephas, with a greatly increased number of cross crests, which become vertical laminæ. The laminar character has become apparent from its rudimental condition in Stegodon.

Now these are stages of development, though not in a continuous, single line. The shedding of the inferior tusks takes place earlier and earlier in the genera from Dinotherium, till they never appear in Stegodon. The molar teeth, it is well known, present, as they succeed each other from back to front, a regularly increasing number of transverse crests in the same species. Thus in Trilophodon ohioiticus the first molar presents but two, while the last presents six. The last molars of other genera present a very much increased number. What is it then, but that the increased number of crests in the third molar, definitive of these genera, is an acceleration of growth; the fourth in Trilophodon is structurally third in Mastodon, and the fourth of Mastodon being third in Pentalophodon, the fourth of Pentalophodon becoming third in Stegodon, and so to the end? This is confirmed from the proven fact of the disappearance of the premolars. They are fewer in Trilophodon† than in

* Baird, Review Birds N. America.

† The genus Mastodon, as left by Cuvier, embraced two genera, as has been clearly shown by that excellent paleontologist, the late Dr. Falconer. He named these genera Trilophodon and Tetralophodon. It appears to us that this was unnecessary, as he was aware that Dr. Godman had named the American Mastodon Tetralophodon from its sometimes persistent inferior tusks, a character distinguishing it from the later genera of the series, though not so trenchantly as the three crests of its third molar, as pointed out by Falconer. As this group was taken from the Cuvierian Mastodon, it should retain Godman's name, for the T. ohioiticus, the T. angustidens and T. humboldti, while Cuvier's name should be preserved for the remainder, viz., M. longirostris, M. borsoni, M. arvernensis, etc., the Tetralophodons of Falconer.

‡ The two-crested and first three-crested molars are usually called milk molars, because early shed. As, however, they are not succeeded by any subsequent teeth, but are similar to those which lie behind them in the jaw, I cannot see why they are not true premolars. Dr. Warren, in his monograph of Mastodon ohioiticus, says "This is called the third deciduous tooth, but why it is more entitled to this epithet than the two which follow it would be difficult to determine. Are not the first and second so-called permanent teeth equally deciduous, since they are shed, and leave the last permanent molar solitary?" V. p. 69. Flower says (Transac. Royal Society, 1867. 638), "In the Dugong and in the existing Elephants the successional process is limited to the incisor teeth."

Dinotherium, and soon shed; they are also early shed in Mastodon and Stegodon (*insignis* Falc. Cant.) and are not known to exist in the succeeding types; the acceleration of succession of teeth has caused them to be entirely omitted. The young tooth of *Elephas* moreover is represented by a series of independent parallel laminae at first, which, when they unite, form a series of crests similar to the type of the genus *Mastodon* and others of the beginning of the series. The deposit of cementum takes place later, till the valleys are entirely filled up. Thus the relations of this part of the tooth structure in the series are also those of the successional growth of those of *Elephas*, or the extreme of the series.

It would be only necessary to show that two distinct conditions in any of these respects occurred among the different individuals of the same species of any of these genera, to render a hypothesis of evolution a demonstrated fact.

It must be here observed that great size indicates little or nothing as to zoological rank. It merely indicates the expenditure of a large amount of stored vegetative force in the individuals of the group, however limited, which exhibits it. The greatest species are often not far removed in affinity from the least; thus there can be but little doubt that Elephants are not far removed from the Rodents, and the Rhinoceros is near the Cony. Indeed, in the same genus the most extraordinary diversity prevails, for we have a very small Elephant of Malta, and in the Miocene of Maryland a fin-back whale not so large as the new-born young of the fin-backs now living. Hence Prof. Dana's objection* to the developmental hypothesis, based on the great size of the primal Selachians and Ganoids, has but little weight.

7. Rathke has shown that the *arteria ophthalmica* of the higher Ophidians is originally a branch of the *arteria cerebialis* anterior, and that it later forms a connection with the *arteria facialis*. This connection increases in strength, while the other diminishes, until finally its supply of blood is derived from the *facialis* instead of the *cerebialis*.

Rathke has also shown that the cerebral origin of this artery is continued through life in the three lowest suborders of the serpents, the *Scolecophidia*, *Catodonta* and *Tortricina*; also in the next succeeding group, the *Peropoda*.

8. In most serpents the left lung is never developed; in such the pulmonary artery instead of being totally wanting, remains as a posterior aorta bow, connected with the aorta by a *ductus botalli*; serpents without left lung being therefore identical in this respect with the embryonic type of those in which that lung exists.

9. Dr. Lespes states that the optic region of the brain of blind cave Coleoptera, examined by him, is similar in structure to that in the blind larvæ of Coleoptera, whose imago possess visual organs.

† 10. Those Saurians, (*Uromastix*, etc.,) in which the premaxillary region is produced into a uniform cutting edge, are furnished during early stages with a series of premaxillary teeth, which become gradually fused and confluent with the alveolar margin. Hence other Acrodonts are equivalent, in this respect, to the young of *Uromastix*, etc. The same thing occurs among the Scaroid and Labroid fishes. In this most natural family we find the majority of generic forms provided with a normal complete dentition; in others (*Chaerops*, *Xiphochilus*, *Pseudodax*, etc.,) the lateral teeth are gradually and normally replaced by a more or less cutting edge of the mandible; and finally, in the *Scarina* and *Odacina* the entire mass of teeth and jaws are coalesced, forming a beak with sharp cutting edges, the single teeth being still visible in the true *Scarus*, while they have entirely disappeared in adult *Pseudoscarus* and *Odax*.‡ Thus in dentition the adult *Scarus* is identical with not fully developed *Odax*; *Chaerops* with the teeth less confluent, equals a still younger

* Manual of Geology, p.

† See under section on acceleration and retardation.

‡ Günther on Hatteria, Philosophical Transactions, 1867, II. I had already noticed the peculiar development in *Uromastix*, but not published it.

stage of *Odax*, while those with distinct teeth are the same in this point as the embryos of the highest—*Odax*, etc. I venture to predict that here will be found a long series of *exact parallelism*, in which the different genera, resting exclusively on these dental characters, will be found to be *identical* generically with the various stages of the successively most advanced.

11. Professor Agassiz states that the absence of ventral fins is characteristic of an embryonic condition of the Cyprinodont fishes. The genus *Orestias* does not progress beyond this stage in this one point. Probably the genus will be found which will only differ from *Orestias* in the presence of ventral fins. If so, *Orestias* will be identical with an imperfect stage of that genus, if, as will probably be the case, the fins appear in the latter, after other structures are fully completed.

γγ. *Parallelism in Higher Groups.*

It is not to be anticipated that the series of genera exhibiting exact parallelism can embrace many such terms, since comparatively few stages in the developmental condition of the same part in the highest, would bring us back to a larval condition, which, as far as we yet know, has no *exact parallel* among existing genera. But it is to be believed that the lowest terms of a number of the most nearly allied of such series, do of themselves form another series of exact parallelisms.

Thus exact parallelism between *existing* genera of mammals ceases with all characters which are larval or fetal only prior to the assumption of the adult dentition, since among the higher mammalia at least we know of no genus which, however similar to undeveloped stages of the higher, never loses the milk dentition. It is nevertheless an important fact that, among smooth brained mammals, or many of them, but one tooth of the second series appears; and inasmuch as smooth brained forms of the higher orders have become extinct, it is not too much to anticipate that a type of permanent milk dentition will be found among the extinct forms of the same high orders.

As an example of exact parallelism in series of series, I select the following:

1. in the Batrachian family Cystignathidæ there are six groups or sets of genera. In the highest of these we have an ossified cranium and xiphisternum—I. e. in the Cystignathi; in the Pleurodemæ the cranium is not ossified, thus representing the Cystignathi while incomplete; in the Criniæ the xiphisternum is cartilaginous, as well as the fronto-parietal region, being an equivalent of a still lower stage of the Cystignathi. From this simplest type we can find a rising series by a different combination of characters; thus the Ceratophydes add an osseous cranium to the incomplete xiphisternum, while two succeeding groups diverge from each other at the start, the Pseudes loosening the outer metatarsus in their development to maturity, while the Hylodes add by degrees a cross-limb to the last phalange. The Ceratophrydes and Criniæ are stages in the development of these, but neither one of them is a step in the development of the other. They are measured by adaptive characters purely.

2. The whole suborder of the Anurous Batrachia, to which the above family belongs, the Arcifera, differs from the suborder Raniformia by a character which distinguishes a primary stage of growth of the latter from its fully developed form. That is, the Raniformia present, at one period of their development, a pair of parallel or over-lapping curved cartilages, connecting the the procoracoid and coracoid bones, which subsequently unite and become a single, slender median, scarcely visible rod, while the bones named expand and meet. The first condition is the permanent and sole systematic character of the Arcifera.*

* This may be readily understood by comparing my monograph of the Arcifera, Journ. Ac. Nat. Sci. Phil., 1866, with Duges work, or Gegenbaur & Parker's memoirs on the shoulder girdle.

Objection.—It may be objected by those who have observed some of these developmental relations, that they are exhibited by certain single structures only, and not by whole organisms. These objectors must not forget that the distinctions of those groups, which alone we have in one geological period in a relation of near affinity, exist in *single characters only*; and that it is therefore infinitely probable that the higher groups, when we come to know their representatives with the same completeness, will prove to be separated by single characters of difference also.

3. The following table is here introduced to illustrate the relations of groups higher than the preceding. This is largely measured by the circulatory system, not only as to the class relations, but also as regards orders. In its less central portions it is, however, definitive of families at times.* [The reader is here referred to the table commencing on p. 256.]

If the reader will compare the history of the development of vertebrates of any class or order, as those of Teleosts and the lizard by Lereboullet, of the snake and tortoise by Rathke and Agassiz, and of the bird and mammal by Von Baer, he will find the most complete examples of the *ineexact parallelism* of the lower types with the embryonic stages of the higher. A few points are selected as examples, from the histories included in a few of the columns of the table, and given at its end.

Similar parallels may be found to exist in the most beautiful manner between the adult anatomy and structure of the urogenital apparatus within each class of the series taken separately, as indicating ordinal relationship. This department is, however, omitted for the present.

As an example of the homologies derivable from the circulatory system, and of the use of the preceding table, I give the following relations between the types of the origins of the aorta.†

The single ventricle of Teleostei is no doubt homologous with that of Lepidosteus, and that of Lepidosiren. The *arteria vesicæ natatoris*, which is the homologue of the *A. pulmonalis* of air breathers, issues in Lepidosteus from the last *vena branchialis*, thus receiving aerated blood from the gills. In Lepidosiren it issues from the point of junction of two gillless and two gill-bearing *venæ branchiales*, thus receiving mixed blue and red blood, or blue blood altogether, when the branchiæ are not in functional activity. In Proteus it issues from the last *vena branchialis*, where it receives the *ductus botalli* of the preceding rein, which, when the gill is inactive, becomes a gillless aorta-bow, which brings it only carbonized blood, which it readily aerates in the swim bladder, now become a lung. The ventricle is homologous with the preceding. In Salamanders, where the substitution of the accessory gill arches by the *ductus botalli*, converts the *arteriæ* and *venæ branchiales* into "aorta-bows," the *A. pulmonalis* is given off from the posterior bow, and receives henceforth mixed blood. In the Anura the origin is the same but nearer the heart. In Gymnophidia it approaches the heart so far as to issue from the extremity of the bulbus arteriosus, which is now divided by an incomplete septum, one half conveying blood to the *aorta roots*, and the other to the *A. pulmonalis*. This septum was already preceded by a longitudinal valve with free margin in the Anura! As if to meet the coming event, a trace of ventricular septum appears at the apex within. There can now be no question of the homology of the ventricles of the gar, and of the Cæcilia. But we have next the true Reptilia. The Bulbus arteriosus is split externally, as it already was internally, but it is first represented in most Tortoises by an adherent portion, one-

* This sketch is not nearly complete, but is published in hopes of its being useful to students. It is compiled from the works of Meckel, Rathke, Barkow, Müller, Hyrtl, Brücke, Stannius and others, in connection with numerous dissections.

† Professor Agassiz (Contrib. Nat. Hist. U. S., I 285) states that the ventricle of the Testudinata "is not any more identical with the one ventricle of fishes, than with the two ventricles of warm blooded vertebrata; for in fishes we find only one vessel, the aorta, arising from it, while in Turtles both the aorta and arteria pulmonalis start together from it." We think this statement, which, if true, is destructive to the asserted homologies of the circulatory system, cannot be substantiated, for the reasons above given.

half being the now, to this point, independent *arteria pulmonalis* and the other the nearly split aorta roots. There can, I think, be little question of the exactitude of the homology throughout.

It is no less certain that the Salamander* fulfils in its development the different stages to its permanent one, and is *identical* in each stage, in *respect to this point*, with the orders it represents at the time. This is true even of the long period during which it bears the long branchial appendages and contained arteries and veins which are not found in fishes; it is then like the *Protopterus*, which has hyoid venous arches and appendages of those arches at the same time. The Tortoise† and *Tropidonotus*, ‡ are also identical in their successive stages with the types already enumerated, the external or appendicular branchial vessels being omitted as belonging to the special serial development of the line of air-breathing Anallantoidans. The division of the bulbus arteriosus into three instead of two may indicate a case of *inexact parallelism*, but on the other hand it may be that the pulmonary partition is completed a little before the aorta-root partition, thus passing through the Batrachian permanent type. For explanations of inexactitude see under Part II. No doubt the Batrachian type of bulbus arteriosus is passed by many serpents less extreme and specialized than the *Tropidonotus*.

The aortic and pulmonary divisions of the bulbus in the *Cæcilia* are not laterally placed, but one is dorsal and the other ventral, the one passing a little spirally to the right of the other. So the pulmonary division of the bulbus turns over to the right in the *Anura*. When the septum of the true reptiles appears it rises on the anterior wall of the ventricle till it is seen in *Eunectes* to meet the partition between the *arteria pulmonalis* and *aorta-roots*, and we have at once the right and left ventricles of the bird and mammal structurally and functionally. Thus are the two ventricles of man the same as the one ventricle of the fish, merely divided by a septum.§

In the fissure of the aortic bulbus in the reptiles a spiral turn is again given, and in *Testudo* the one aorta-root issues behind the other. In the *Crocodile* the turn is still greater, and the right aorta-root issues to the left of the left root, and vice versa. In the birds we have lost the left root, and parallelism ceases with this change. In the mammalia the right root turns to the left, so that in the comparison of these classes the rule of Von Baer above quoted is true; no mammal at present known is identical in a foetal stage with any fully grown bird, but with a foetus of the same, up to a certain point. But for both classes the parallelism of those below them holds true.

But it is with the exact parallelism or identity of genera that we have to do in the present essay. That being established, the inexact parallelism between the modern representatives of higher groups, follows by a process of reduction.

§. The extent of parallelism.

Prof. De Serres and others have stated it as their belief that the lower "branches" of the animal kingdom are identical with the undeveloped forms of the higher; i. e. that the mollusc and articulate are not merely parallel with, but the same as the lower conditions of the vertebrate. The works of various embryologists as Von Baer and Lereboullet, have shown this statement to be erroneous "and founded on false and deceptive appearances." The embryos of the four great branches of the animal kingdom appear to be distinct in essential characters, from their first appearance. But Lereboullet, who, in his prize essay, has compared with care the development of the trout, pike,

* Amblystoma. † Agassiz. ‡ Rathke.

§ Agassiz, l. c., denies the homology of the ventricles of the turtle and mammal, but it appears to me erroneously. He says: "The fact that the great blood vessels (aorta and art. pulmonalis) start together from the *cavum venosum* seems to prove that the two cavities in the heart of turtles, which are by no means very marked, do not correspond to the two ventricles in mammalia and birds."

| | Heart sec. | Auricles. | Ventricles. | Atrio-ventric. valvz. | Trunc. aortico-pulm., or aortico-bulbus valvz. | Auriculo-sinuous valvz. |
|-------------------|---|--|--|---|--|--|
| Leptocardi | None | None | One elongate | None | None | None |
| Dermopteri | Pres'nt, att. to heart at <i>snout & trunk</i> . | Present. Septum none. <i>Externally</i> one. Poster. to ventricle. | One, oval | Orifices 1; two valv's; membranous; no columnar or chordae. | A. To trunc's branch'l. Two semilunar. | Double. |
| Hyperotreti | Open into abd'm. cav. | | | | | |
| Hyperoarti | Clos'd in petromyzon | | | | | |
| Elaenobranchii | Conn. by tube w. abdominal. cav. | | One trans.; (2) musc. reticul.; no columnar. | " " two valvz. | B. To bulb's arterio's. | " with threads. |
| Pinglostomi | a. Bifurcate. | | | | | |
| Holoecephali | b. Simple. | | | | | |
| Teloostei Apodes | Closed; conn. w. heart by bands in murena and some Gadidae. | Opposite ventr. | (One, pyramid'l; (2) " | " " two valvz. | Two (4 in Orthogoriscus). | " (Four in Orthogoriscus); threads not constant. |
| Eventognathi | | Opposite ventr. | | | | |
| Heterosomata | | Opposite ventr. | | | | |
| In general | | Dorsal ant. | " with vascularele- (2) " | " " two valvz. | | One, annular, split, each half w. pocketa. |
| Ganoidei | Conn. w. abd. by simple duct. | Dors. ant. No sept. | vessels to pericard m. One, pyriform. (3) " | " " chordae tendineae. | | Double. |
| Chondrostei | | | w. trabeculae carneae. | " " $\frac{3}{4}$ the apert' bound'd by one valve. | None | |
| Holostei | | | | | | |
| Lepidosteus | Only a deep concav. towards abd. cav. | | | | | |
| Polypterus | Closed. | Dors. ant. An incomplete septum. | One, pyriform | " " ; one valve bound'd by chordae cartilagineae. | No semilunar | None. |
| Dipnoi | Closed | A complete septum. | | Two orifices. | | |
| Batrachia Urodela | Closed; att. by infer. 3d of post face. | A complete septum. | | " " | | |
| Protelida | Closed; att. to apex in Amphituma. | A complete septum. | | " " | | |
| Trachystomata | | A complete septum. | | " " approxi- mate, small. | One at orifice of, of the two primary div. of bulbous. | None in Pipa. |
| Trematoda | | A complete septum. | | Two orifices. | Three semil. at ostium bulbi. ? valv. at m'th of bulb. | |
| Myxodora | | | | | | Two. |
| Anura | | | | | | |
| Gymnophiona | | | | | | |
| Reptilia | Closed | A compl. sept. Externally two. | | One. One | 2 semil. 2 \| 2 semil. p. | Two. Two. semilun. |
| Lacertilia | | | Walls not thick; very coarse network in sin. arteriosis. | | | |
| Amphisbaenia | | | | | | |
| Ophidia | | | | | | |

[Oct.

| Testudinalia | Closed; att. by infer. 3d of post. face. | A complete sept. . . | " 1 & 2 " 3, 4, (5) walls very thick & spongy; oesaculum on anter. end, complete side of septum. | Two; the One. right rudimentary. | 2 semi.; 2 2; inner semi.; in-on oesaculum. n'r of both lum. on oesacu. | Two semi. |
|------------------|--|--|--|---|---|----------------------------------|
| Crocodylia | " " " | A complete sept. . . | Two, sept. complete; 2 & 4 " occasion perforations near apex. | Two; the One (for 2); right muscular. | 2 semi.; 2 2 semi. | " |
| Aves | Closed | A compl. sept. Externally slightly separated fr. ventricles. | 1 " 2, musc. trabeculae & column. carn. in septum convex into right ventr. | Two; right Two. large, musc. | 3 " " | " inferior — valvula eustachil. |
| Cursores Apteryx | Closed | A complete septum. | 1 & 2 " walls more compact. | Chordæ tendineæ sinistres. 3 ("tricus. 3 ("militar. All membranous & bound by chordæ tendineæ; in monotremata; two in mitral, w. are att. to columæ carnea. | " " 3 " | One = v. eustachil; rudimentary. |
| Mammalia | Closed | Right, small. | Separated for some length. | | | |
| Implacentalia | | No fossa ovals on septum. | | | | |
| Marupialia | | | | | | |
| Placentalia | | | | | | |
| Hallicores | | | | | | |

| Leptocardii | Post-ventricular cavity. | Arteries branchiales. | Vena branchiales. | Arteria pulmonalis. | Vena pulmonalis. At first v. recta puerum. | Art. subclavie. |
|----------------|---|--|---|----------------------------------|--|----------------------|
| Dermopteri | I. Series of lateral alternating bulbilli. II. Truncus branchialis communis. | One from each bulb. (A pair of ant. or false aort. bows; rudimentary in Hyperotrelli.) Pr. truncus; 7 usually ant. somewhat united, — bifurca. of truncus. Pr. truncus. 6; fr. bulbos; 2 ant. united. | Enter aorta direct; All separate. 7 united. | None (no swimming bladder). " | None. " | |
| Elasmobranchii | III. Bulbus steriosus w. musc. coat & 2 or more rows valves. | Three post. septa. Three post. united. Three post. united. | Anterior united | " | | From origin of aort. |
| Plagiostomi. | | | | | | |
| Squali | | | | | | |
| Rajæ | | | | | | |
| Pristes | | | | | | |
| Holocephali. | | | | | | |

| | Post-ventricular cavity. | Arteris branchiales. | Vene branchiales. | Arteria pulmonalis. | Vena pulmonalis. At first a recte pneuma. | Art. subclavia. |
|-------------------------------|--|---|---|---|---|---|
| Teleostei | IV. Bulbus arter. without musc. walls, no valves. (exc. <i>Bufo</i> & <i>Tytrinus</i> .) | <i>Fr. truncus</i> which is fr. bulbous; 4 on each side (anterior ventricle). a. Two ant. separate. b. Two ant. united. 1. All togills. 2. Post. sending art. to air sac, = branch. opere. ** Post. not sending art. to air sac, = bran. opere. 2. 4th no gill, = aor. bow. | <i>Enter aort.</i> by a. roots, i. e., by poster. trunk of truncus or direct when poster. completion of circulus. | 3 Empties into port: al. hepatic or cardinal vein. | Into vena hemizygia or from vertebralis posterior: often of anter. vena subdivides into rete, chiales Esch. and unites. | Origin often unsymmetrical. Comm. trunk posterior: often of anter. vena subdivides into rete, chiales Esch. and unites. |
| Apodes Muraenophis | | | | | | |
| Nematogn. Saccobrachius | | | | | | |
| Class in general. | | | | | | From origin of aort.; Perca. Fr. each aorta root; Gadus. |
| Ap. Symbranchus Monoplerus .. | | | | | Into v. portae in Lota. | |
| Amphipnous .. | | | | | | |
| Ganoides | V. Bulbus arter. w. musc. walls and 3 or very many rows valv. | <i>Fr. truncus</i> , fr. bulbous; 5 on e. side; ant. is an opercular peduncle-branch; and rovent art. 1. Rising from 2d art. branch. a. 1st true branch; to 2d gill; 2d and 3d united. b. 1st true br. art. to 1st gill. 2. Rising fr. & ant. fork of truncus; 1st true art. br. to 1st gill. | <i>Enter aorta</i> direct. | | | From origin of aorta, then dividing into 3; one branchialis, one lateralis; one dorsal ascend. |
| Chondrostel .. | | | | | | |
| Spatularia | | | | | | |
| Acipenser | | | | | | |
| Holostei | | | | | | |
| Lepidosteus Polypterus .. | | | | | | |
| Amia | | | | | | |
| Dipnoi | VI. Bulb. arter. spirital, w. two elongate spir. valves. | Four on e. side fr. truncus, 2 ant. united. <i>Fr. 2 primary heads of bulbous</i> ; 5 on e. side; 1st rising fr. 2d; 2d & 3d gills; 4th to 3 gills. 5. Trunc. to 2d gill. b. No " | <i>Enter two aorta-roots</i> ; two become parts of aorta-bows. | From last vena branchialis. ? Empt. into vena cava ascend. | <i>Enters hepatic vein</i> . " vena cava ascendens. <i>Enters auricula sinistra</i> , passes vena cava & sinus & has valv. tuberc. at ostium. | Very large: fr. aort. poster. to entrance of 3d vena branch. communis. |
| Protopterus | | | | | | |
| Lepidosteon | | | | | | |

[Oct.

| | | | | | | | |
|--------|--|--|---|--|------------------------------|---|---|
| 1868.] | Batrachia | VII. Bulb. not mus- cular; a longitud. v. Bulb. narrow at be- ginning. | Prim'y div. of bulb. = 2 trunc. br. comm.; 3 Art. br. on each side, 2 post. united first, a, b. From bulb; 3 on each side. | Are both ven. branch and aorta-bows, from existence of 3 duct. botalli. | From poster. vena branch. | " | From aorta. |
| | Proteida | Bulb. twisted; one longit. elevat. (= sep- tum) w. six grooves corr. to art. branch. | Become <i>aorta bows</i> from want of gills. Four; ant. & post. conn. by duct's botalli; 2 median = aorta root. Four; ant. & post. conn. by duct's botalli; 2 median = aorta root and with one ostium into bulb; art. Three; no ductus botalli; median = aort. root. | Fr. poster. aort. bow. | " | " | " |
| | Trachystomata | | | | | | |
| | Trematodera | | | | | | |
| | Mycetodera | | | | | | |
| | Anura | Contain. longit. sep- tum w. a free edge; each half prolonged into 1 primary div. of bulbus. | One; by obliteration of 1st and last, <i>aorta</i> roots only remain. | Fr. dorsal chamber of <i>bulbus arteriosus</i> . | | | |
| | Gymnophiona | Elongate; div. an- terior. into dorsal & ventral cham.; valves at origin. | | | | | |
| | Reptilia | VIII. No proper bulbus; the aorta roots and pulm. art. ad- herent. | | From cavum veno- sum = (dextrum) of ventricle. | | | From trunc. subclav. comm.; fr. right aorta root. |
| | Lacertilia in gen. Varanide and Tupiaimbis } | | Two aort. bows, fr. comm. ostium fr. cavum arteriosum (sinistrum). | | | | |
| | Amphisbenia- Ophidia | | One aorta bow, = aorta root. One " " " " | | | | Each fr. inno-min. fr. trunc. inno-min. from right aorta root. Dextra fr. right aort. root; sinist. fr. inno-min. Sinistra very large; given from aorta im- mediately; first as in- nominate. |
| | Testudinata | Aorta roots and art. pulm. adherent and surr. by ring of musc. tissue at origius. | | | | | |
| | Crocodylia | Aorta roots and pulm. art. adherent; right aorta root from left ventr., left from right, commun. by a foramen above valves. | | | | | |
| | Aves | IX. Right aorta root (fr. left ventr.) only = aorta. | | From right ventri- cle; attached. Do. Free. | | | |
| | Mammalia | X. Right aorta root (i. e., aorta) turning over the left bronchus to the left side. | | Do. | | | Dextra issues later; sometimes an inno- minata. |

| | Carotides. | Cerebrales. | Ophthalmicae. | Vertebrales. | Intercostales. |
|---|--|---|---|------------------------------------|--|
| Leptocardii. Dermopteri. Hyperostei | 1. Each carot. communis a continuation of a vessel connecting veins branch. parallel to aorta. Divide to c. ext. and lat. behind skull; intern. unite at base of cranium and receive vertebralis. 2. Carot. communis from anter. vena-branchialis. Carot. intern. do not unite. 3. No c. communis; posterior from 1st vena branch. or from united anterior ven. branchiales; united beneath cranium. (a.) Anter. carot. from pseudobranchia, 1. 6, vena branch. prima. b. Ant. ("poster.") from ven. branch. secunda. 4. C. commun. from circulus cephalicus. As in 3 (a). | Median from con- junction of carot. in- tern. | ..... | Median, a continua- tion of aorta. | ..... |
| Hyperostei ..... | ..... | ..... | ..... | ..... | From aorta direct. |
| Elasmobranchii ..... | ..... | ..... | Fr. pseudo-branchi- es in "glandula chloridalla." | ..... | ..... |
| Plagiostomi ..... | ..... | ..... | Fr. carotis anterior. | ..... | ..... |
| Holocephali ..... | ..... | ..... | Fr. pseudo-branch. | ..... | Often break into retes. |
| Teleostei ..... | ..... | ..... | Fr. pseudo-branch. | ..... | ..... |
| Ganoidei ..... | ..... | ..... | ..... | ..... | ..... |
| Chondrostei ..... | ..... | ..... | ..... | ..... | ..... |
| Holostei ..... | ..... | ..... | ..... | ..... | ..... |
| Lepidosteus | 5. Anter. carot. from aorta, anter. to entr. of 3d pair of v. branchiales; poster. carot. sending no branch to brain. As in 3 (b). | From near origin of aorta. | Fr. pseudo-branch. | ..... | ..... |
| Dipnoi ..... | ..... | ..... | ..... | ..... | ..... |
| Batrachia ..... | ..... | ..... | ..... | ..... | ..... |
| Proteida | As in 3; (c), the 1 anter. ("post.") carot. from aorta bow. | ..... | Fr. carotis anterior. | ..... | ..... |
| Trachystomata | 6(a) Carotis comm. from anter. aorta-bow. | ..... | ..... | ..... | In pairs from aorta. |
| Trematodera | No glandula carotica. | ..... | ..... | ..... | Small; from an "a. supravertebralis" |
| Mycodera | 6 (b). A glandula carotica. | ..... | ..... | ..... | run'g. sh. diaproph. on each side, homolog. w. intercostal, prim.) |
| Anura | 6 (b). Carot. extern. cont. 1st as max. in- tern. and then ophthalm. | ..... | ..... | ..... | ..... |
| Gymnophiona | 7. Carotis commun. from anter. curve of each aorta root. | ..... | ..... | ..... | ..... |
| Reptilia | A. Carotis poster. connected w. its fellow by ramus communicans behind foramen magn. | B. Continuation of carotis interna. Cir- culus Willisii complete. | From A. facialis (= carot. ext.) more or less connected with cerebr. anter. | ..... | ..... |

| | | | | | |
|--|---|--|--|---|---|
| Ophidia | 8. Both carot. commun. from right aorta-root direct. (a). Entirely separate. (b). Running together after issuing from a short tr. carot. impar. (c). Left carot. comm. rudimentary. (d). " " absent. | | | One from trunk, arter. dexter.; divides; each half running beneath diaphragm & entering ramus com. of carotis internal; through this to basil-aris. | Fr. trunc. art. dex-ter., fr. comm. truncus fr. aorta. |
| Peropoda } Angioleptomata } Amphisbaenia } | 7. Each carot. comm. from anter. part of each aorta-root. | | | Fr. cerebri anter. From ? | In Rhinophis strong, like a cont. of aorta. |
| Lacortilla | As in 7. | | | Fr. art. facialis ... | Two from axillaries; each entering spinal canal and forming a suprascapular thro' those to basilaria. |
| Varanidae and Tuphanibis In general ... | 9. Each carot. comm. a continuation of carotide extrem. of antier. aorta low. | | | Fr. cerebri anter. | In body and tail fr. an intercostal, prima continued fr. subel. illiac, the "intern. re-curvens". In neck from ram. comm. fr. carot. ext. to subclav. |
| Tesudinata | 10. Each c. c. from innominat. fr. common innom.; from right aorta root. | | | " " | Usually from aorta. |
| Crocodylia | 11 (a). Car. comm. fr. truncus carot. Impar. w. is from left innom.; or (b) c. com. each from an innom.; all from right aorta-root, or as in 10. B. No excep. union of carotides posteriores: (a). Car. comm. fr. tr. carotic. impar. fr. left innom. [vid. on Pitua sp. Tid-schir, Neederl. Ind.] | | | External branch of B. Truncus cervical carotis internus. | I. Not forming ba-siliaris; conn. w. ocul-pitalis. From truncus or carot. communis of its side. |
| Aves..... | one or both c. com. run on sides of neck. | | | | In Gallus, a few fr. intercost. prima, in Ciconia last from Epi-gastr rest fr. prima. |
| Insectores | (a). Car. comm. fr. tr. carotic. impar. fr. left innom. [vid. on Pitua sp. Tid-schir, Neederl. Ind.] | | | | In Anas 5 or from intercost. prima, 3 or 4 fr. vess. connect. In-terc. prima w. aorta. |
| Passerinae } Zygodactyl 2/3 Syndactyl 1/3 } | | | | | |
| Synactylif } Zygodactyli cu- } culus and in } general excr. } | | | | | |
| Nitidiores Podiceps As (a). | (b). Carot. commun. from each innom. from aorta. | | | | |

| | Carnivores. | Urbivores. | Ophthalmices. | Vertebrales. | Invertebrata. |
|---|---|---|---|---|--|
| Cursores Botaurus " Phœni-opterus | As in 11 (b)! | Via canal carot., or foramen jugulare. | | | |
| Mammalia..... | (c). Carot. comm. from right innom. from aorta. | Ramus communic. betw. cerebr. auter. C. | | 3. Forming basilar. | |
| Implacentalia..... | d. One car. comm. fr. innom. dextra fr. aorta; one from aorta direct. | willisi alwys presnt. | | | |
| Phascelomya & Phascolactus..... | c. Both c. c. fr. innom. dextra; fr. aorta. | Sonet. ramus comm. is between art. corporis callosi. | | | |
| Marsupialia..... | e. " " " | Fr. carot. ext. via a. ophthalmic and forami. opt. in some Cavilidae; | Sclurus=Intern. br. of ant. cerebr. (br. ext. leaves cran. and joins max. interna). Arcto- mys same, without extern. branch. | In Mustela fr. tr. communis vertebr. fr. fr. tr. com. verteb. aorta. | In Mustela, anterior |
| Placent. Rodentia..... | except Muridae, Cricetina, Dipus Merio- nes, which exhibit d. | via max. intern. and foram. lac. anter. Hy- trix. | | | |
| Proboscidea..... | f. From truncus car. impar.; fr. aorta di- rect; Elephas. | From carot. ext. via max. intern. in Ovis. | Sus; from max. int. =carot. ext. | 2. Connected with occipitalis; w. basilar by small branches. | |
| Artiodactyla..... | g. From truncus car. impar.; from right innom. Sus. | | | As in 1 | |
| Perissodactyla..... | h. Each c. com. from right innom.; from innom. communis. | | | As in 3 | |
| Equus..... | i. From tr. carot. impar.; from r. innom.; from innom. communis. | | | | |
| Cata- (Haliore As e. As i. Phocena As i. Delphinidae | k. No carot. comm. Carot. intern. and ext. fr. innom. | | | 4. Confluent w. oc- cipitalis and cervic. as- cend. = "cervico-oc- cip." As in 2 in Canis, Mustela. | 5. Anter. fr. mam- mar. intern. |
| Carnivora..... | As in e, except Phocidae=d., also Brachy- pus, Daelypus and Cyclothorus. | | | | |
| Edentata..... | As in e..... | | | | |
| Insect- (Sorex As in i. As in d. Ivora (Erinaceus | As in e, except Phocidae=d., also Brachy- pus, Daelypus and Cyclothorus. | | | | |
| Cheloptera..... | l. C. comm. fr. each innom.; fr. aorta. | | | | |
| Quadrumania..... | As in d. | | | | |
| Homo..... | | | | | 1st fr. subcl. rest of dors. div. from aorta. |

[Oct

| | <i>A. costata.</i> | <i>A. mesenterica.</i> | <i>A. iliaca.</i> | <i>Sinus renosus.</i> | <i>Vena anonyma.</i> | <i>v. Hemistygæ or Ventrals pudor.</i> |
|--|---|------------------------|--|-------------------------------|----------------------|---|
| Lepicardi Dermopteri..... | From aorta..... | ..... | ..... | a. Present; con- tractile. | ..... | I. Supravertebral (a continuation of cau- dalis) On left side only. On both; equally II. Two, called "Trun- ci transversæ." Re- large. (In Petromy- celve subclavian ver- zom conn. w. subvert. tebrales and hemia- zygeæ.) |
| Elasmobranchii..... | " Includes Mesen- terica anterior. | A posterior only. | ..... | Present..... | ..... | II. Subvertebral. a. Emptying into anonyma. * Of equal size. Re- celve renales reve- hentes. |
| Plagiostomi Squali..... | In Lamna sp. devel- oped; retea nribiles near diaphragm. | ..... | ..... | ..... | ..... | Conn. w. a subvert. sec. |
| Pristes Raja..... | [Mesent. ant. separato | ..... | ..... | ..... | ..... | * The dexter larger. |
| Holocephali Teleostei..... | [In Thynnus a sub- hepatic rete. [In Gadus g. from aorta root. | ..... | ..... | Present..... | ..... | * Of equal size (Dio- don). |
| Plectognathi..... | ..... | ..... | ..... | ..... | ..... | * Of equal size; breaking into spongy masses or retea in Acipenser. |
| Ganoidi Chondrostei..... | ..... | ..... | ..... | ..... | ..... | Do not receive re- nal revuls. aa. Emptying into iliaca. Two, equal. |
| Holostei Dipnoi..... | ..... | ..... | ..... | Present. " | ..... | ..... |
| Batrachia..... | " Gastrica separate from aorta. | Many, small..... | Symmetrical. | ..... | ..... | ..... |
| Protida Trachystomata Trematodera Myxodera..... | " Gastrica indepen- dent. | Two, anter. & post. | Give femoralis and epigastrica. Rise at mid. of coccyx | ..... | ..... | ..... |
| Anura..... | From left a. root, in- cluding both mesen- terics. | ..... | ..... | Present. | ..... | ..... |
| Gymnophiona Reptilia..... | ..... | ..... | ..... | Present. | ..... | ..... |

| | <i>A. celica.</i> | <i>A. mesenterica.</i> | <i>A. stica.</i> | <i>Sinus venosus.</i> | <i>Ventral anomya.</i> | <i>r. Hemistaryx or Ver-</i> <i>ebialis poster.</i> |
|----------------------|------------------------------------|--|---|--|---|--|
| Ophidia | " Four gastricae. | " " | " " | Continuation of anomya dextra and v. cava inf. | An. sinistra the continuation of jugularis only. | a. Emptying into Anonyma. One median. |
| Amphisbaenia | From aorta.) | United, fr. left a. r. | Hypogastric & cruralis separate. | a. Present. | " | III. Above heads of ribs coun. illica and anonyma. |
| Lacertilia | One, incl. gastr. and aorta root. | One, fr. left a. root. | " | ? | " | II.? |
| Testudinata | A gastroploica instead. | Super. fr. aorta; inf. fr. caudalis s. sacralis media. | 1. <i>Novae</i> ; cruralis & hyp. g. separate; later fr. caud. s. sacralis med. not giving ischiadica, w. rises from aorta & is larger th. cruralis. Cruralis and hypog. mostly separate. | a. Absent. | Coronaria enters an. sinistr. anonym. from union of vertebrales trunk then ent. anon. first, then jugularis, yma. then subclavia. | III. a. Each unites w. ant. verteb. Comm. union of vertebrales trunk then ent. anon. first, then jugularis, yma. then subclavia. |
| Crocodylia | " Fr. ab. diaphr'm. One fr. aorta. | Sup. fr. ab. diaphr. Independent. | " | " | " | (II.) aa. Enter v. cava descend. or anter., or the two anonym. |
| Aves | " | Infer. wanting. | Ischiadicae fr. aorta ((larger than cruralis) -hypog. of Meckel?) | " | " | " |
| Mammalia | " | Infer. present. | Ischiad. fr. hypogastr., etc.? | " | " | " 1. Two, equal. |
| Implacentalia | " | Super. wanting in Canis. | " | " | " | " Except? |
| Monotremata | " | " | " | " | " | 2. One, or dextra much larger. |
| Marsupialia | " | " | " | " | " | " |
| Placentalia | " | " | " | " | " | " |
| Rodentia | " | " | " | " | " | " |
| Proboscidea | " | " | " | " | " | " |
| Perissodactyla | " | " | " | " | " | " |
| Solidungula | " | " | " | " | " | " |
| Cetacea | " | " | " | " | " | " |
| Carnivora | " | " | " | " | " | " |
| Edentata | " | " | " | " | " | " |
| Insectivora | " | " | " | " | " | " |
| Cheloptera | " | " | " | " | " | " |
| Quadrupana | " | " | " | " | " | " |

| | <i>Pena caudalis.</i> | (<i>V. vertebrata et</i> <i>V. Jugularis (extern.)</i>) | <i>V. cava ascendens.</i> | <i>V. flacca.</i> | <i>V. porta.</i> | <i>V. hepaticæ.</i> |
|------------------------------|---|---|---|--|--|--|
| <i>Leptocardi.</i> | | | | | | |
| <i>Dermopari.</i> | A. Single. a. Prolonged directly into hemiazygos. | A. Does not take blood from brain. Single (enters sinus venosus) on left side. (a). Verteb. sinister only (fr. skull). (b). Two vertebral (from skull) mostly receive subclavia. 1. Double; one each side. Verteb. take blood from skull. | None | | Contractile rhythmically. Fr. aliment. canal and organs. (a). Contr. rhythmically. Receives veins of abd. wall. Has a sac-like expansion. (b). Not contractile. | 1. Two or three; empty into sinus venosus. |
| <i>Hyperotreti.</i> | | | | | | |
| <i>Hyperoarti.</i> | | | | | | |
| <i>Elaasmobranohii.</i> | | | | | | |
| <i>Plagiostomi.</i> | Common Intercoat. trunks sub-divided in kidneys. | | | | Concealed in margin of spiral valve. Finally single. | Exhibit sinuses. |
| <i>Rajæ.</i> | | | | | | |
| <i>Holocephali.</i> | | | | | | |
| <i>Telostei.</i> | b. Continued as renalis advehens; as sin. in Cottus, Thynnalis, receives common; often dilate into trunks of 2 or 4 intercostals. | 1. or single (entering sin.) in Cottus, Thynnalis; often dilate into sinuses. | " [present in Perca, from spermatica and pneumatics; does not ramify in liver.] | | Often rec. veins of walls of abdomen (homolog. of epigastrica). Often tr. to liver are very numerous, esp. Eventognathi. | 11. Mostly one; often two; rarely three. |
| <i>Ganoidea Chondrostei.</i> | | | None. | | One trunk. | One. |
| <i>Polyodon.</i> | | | | | | |
| <i>Acipenser.</i> | | | | | | |
| <i>Holostei.</i> | | | | | | |
| <i>Dipnoi.</i> | Divides to join renalis advehens. | | | | | |
| <i>Batrachia.</i> | | B. Takes blood fr. brain. | A. Present; formed fr. renal. revehentes. Passes through liver. | | From a median abdominalis anter., or epigastrica. | a. Empty into v. cava ascend. |
| <i>Trachystomata.</i> | | | | | | |
| <i>Protoide.</i> | | | | | | |
| <i>Myxodera.</i> | c. Forks, each fork uniting w. cruralis. | | | 1 a. From fork of caudalis & cruralis. a. Forks of caudal. — a transv. anastomosis. | | |
| <i>Anura.</i> | None; cruralis—renalis adv. | | | | An origin fr. each illaca. | |
| <i>Gymnophiona.</i> | | | | | | |
| <i>Reptilia.</i> | | | | | | |

| | <i>Vena caudalis.</i> | (<i>V. vertebialis</i> & <i>V. Jugularis (externa)</i>) <i>V. Jugularis</i> only into anonyma. | <i>V. cava ascendens.</i> | <i>V. ilioaca.</i> | <i>V. portae.</i> | <i>V. hepatica.</i> |
|-------------------------------------|--|--|---|--|---|---|
| Ophidia | | (1.) Dexter only into anonyma. | | From fork of caud. (—hypogae.) only on left; on right from caudalis and abdom. impar. | Is continuation of v. abdominals w. rec. left; v. of aliment. canal & accom. organs; con- tains a long spiral valve; originates fr. illica; dextra only. An origin fr. each illica. | |
| Amphiblenia | | | | | | |
| Lacertilia | | | | | | |
| Testudinata | B. Double; ab. diapo- pyses. | Fr. cranial sinuses. | | Fr. caud. (<i>hypogaeus</i>) and cranialis. | Three; 1st from two symmet. v. abd. ant. 2 fr. do. abd. post. 3d fr. v. tract. intestinal. | b. Empty into atri- um dextrum. |
| Crocodylia | A. Single; hypaxonic. | | Formed from renal revelis. and branches of illica. | AA. <i>Is not renalis</i> adv. 1. Sends off large ren. adv. takes up ren. rev. [Previously conn. by anast.] con- tinued as abd. anter. 2. Fr. hypogae. and cur. hypogae. a con- tinuation of lat. fr. of common caudalis; as such perforates kid- ney.] | Three; an abd. fr. a v. of aliment. canal & organs. | a. |
| Aves | Two, unite and con- tinue into V. portae. | A. Do not receive bl. fr. brain, or a small branch only. Not near course of carotids; an anastomosis nr. head; right is larger, or alone (as in <i>Falcus</i> sp.) Subst. by verteb. Run in cervic. canal. | A. Fr. illica; receiv's abdom. ant. after he- paticae. | | Comm. trunk from united caud., taking up v. tractus intest. (—mesenterica) or former is a right v. portae, the latter one or more v. p. sinistrae. | a. Usually 2 dext. & sinist. in liver. |
| Mammalia | | | | Not imb. in kidney. | | |
| Insectalia | | | | 2. No part of hypo- gas. passes thr. kidn. | From splenic and a sup. mesenter. only. | |
| Reptalia and Pro- Batracia | Ent. v. cava ascend. Ent. v. cava ascend. bocidia. | B. Take blood from brain; verteb. small in cervic. canal. | B. Through groove of liver only. | | | |
| Artiodactyla | | | | | | |
| Perissodactyla | | | | | | |
| Cetacea | In many into right illica. | | With expansions in most diverta. In Phoca enclosed by contractile mus- cular ring at diaph'n. | | Semilunar valves in Bos. | |
| Carnivora | | | | | Semilunar valves in Equus. | |
| Edentata and In- sectivora | | | | | | |
| Chiroptera | | | | | | |
| Quadruman | | C. Take no blood fr. brain; jugular intern. do this. | | | | |

[Oct.,

and perch of the Teleosts, with that of a *Lacerta* among reptiles, has failed to point out characters by which the embryos of the two vertebrate classes essentially differ, for a considerable period. It is true, that as each and all of the species belong to widely different generic series, parallelism is of the kind to be called *inexact* or *remote*. But enough is known of embryology and paleontology to render it extremely probable that the historic predecessors of the types whose embryology Lereboullet studied, formed a series of parallels of the kind termed in this essay *exact*.

Lereboullet states that a certain difference exists between the eggs of the fishes and those of the *Lacerta*. This is for us merely stating that the parents of the embryos differ, a fact which no one will contest. The same may be said of the elevated or depressed character of the surface of the vitellus on which the embryo reposes.

Secondly, after the appearance of the embryo the *Lacerta* is furnished with the amnios and allantois, the *Teliost* not. This is certainly neither a generic, ordinal nor class character of the adult, for it is but temporary; therefore in generic, ordinal and class characters the embryos of the *Teliost* and Reptile are still identical. It is a physiological character and not morphological, and therefore far the less likely to be a permanent one, even in embryos, under changed circumstances. The female of one of the species of *Trachycephalus* inverts the skin of the back at one season of the year to receive her eggs, because she cannot lay them in the water; the other species of the genus do not. The next genus in direct morphological line possesses a single species whose female does the same for the same reason; but the relations of these species and genera are zoologically the same as though this modification did not occur. Many such instances will occur to many naturalists. It is not pretended that they are as important as the presence of the allantois; but they constitute a character no doubt similar in kind, and entirely at the service of the needs of the great system of morphological succession. The same may be said of the vascular area of the Reptile.

Lereboullet concludes his summary of the differences between the *Teliost* and Reptile, up to the period of completion of the heart, by saying "It is easy to perceive that all these differences, however important they may appear, are constituted by the accessory organs of the embryo, and do not modify the development of the latter, which progresses in reality exactly as in the fishes." He says the same previously, as to the relation of the same to the bird and mammal.

We have then in the embryos of the lower vertebrates at a certain time in the history of each, an "*exact parallelism*" or *identity* with the embryonic condition of the type which progresses to the next degree beyond it, and of all the other types which progress successively to more distant extremes.

We have, however, so far, every reason to suppose that the embryos of the other branches of animals never present an exact parallelism with those of the vertebrata.

The embryo of the fish and that of the reptile and mammal may be said to be generically if not specifically identical up to the point where preparation for the aerial respiration of the latter appears. They each take different lines at this point. The fish diverges from the course of the reptile and proceeds to a different goal; the shark does the same, but proceeds a shorter distance, while the Dermopter scarcely leaves the point of departure. No doubt there have been types which never left this point, and whose plan or circulatory system is identical with that of the embryo Reptile and Mammal. *Such a type was only generically different from the reptile or mammal which had only taken the succeeding step, provided other structures were not super-added.*

By comparing the development of types of different classes in certain features which are only ordinal or generic in meaning, very erroneous conclusions may be reached by the inexact student, as to the want of parallelism of classes to each other. Thus Rathke says of the development of the eye of the Tropic-

1868.]

donotus at a certain period, that it is far in advance of that of the mammal at the same stage. Here, says the objector, is a case where their parallelisms do not coincide; the mammal is really similar to a younger stage of the Reptile.

But, in fact, the size of the eye is but a generic or family character; if the development of the lemur had been compared with the snake, the mammal would have been found to be in advance; if the mole, much farther behind. If the snake selected were the purblind *Atractaspis*, almost any mammal would have been in advance; if, on the other hand, the great eyed *Dipsas*, but few mammalia would have been parallel to it.

In a word, to find *exact parallelism* it is necessary to examine the closest allies.

It is also of first importance to distinguish between the *existence* of generic or higher characters, and their condition under various circumstances of *individual life*. If a foetal or larval character be conserved through the adult life of a type, it will be of course adapted to the functions of mature age. Thus the undeveloped character of the horns of the genus of deer, *Rusa*, are not accompanied with the marks of individual youth of the corresponding stage of *Cervus*; its individuals are fully grown and *functionally* perfect. The species of *Hyla* are not small and incapable of self preservation and reproduction, as is the corresponding stage of *Trachycephalus*; they are functionally developed. The student need not be surprised, then, if, when identity or exact parallelism is asserted, he finds some differences dependent on age and adaptation, for if he be an anatomist he need not be informed that a morphological relation constitutes types what they are, not a physiological.

II. Of retardation and acceleration in generic characters.

First. Of adult metamorphosis.

The question has necessarily arisen—have these remarkable relations between genera resulted from an arrangement of distinct generations according to a permanent scale of harmony, or have the same genetic series of individuals been made to assume the different positions, at the same or different periods of the earth's history.*

Prof. Marcel de Serres proposed the theory of repressions of development to account for the existence of the lower groups of animals *as now existing*, an error easily exposed, as has been done by Lereboullet in his various important embryological writings. But little observation is sufficient to prove that a mammal is not a shark where it has five gill arches or aorta bows, nor a batrachian where it has three, or a reptile where it has the two aorta-roots. This has been already sufficiently pointed out by Von Baer, who says there is "Kein Rede," of such a theory as was afterwards proposed by de Serres. Thus are true the rules propounded by this author.† 3. "Each embryo of a given animal type, instead of passing through the other given animal found, diverges still more from it." 4. "In the basis, therefore, the embryo of a higher animal type is never identical with an inferior type, but with the embryo only of the latter."

* Some naturalists seem to imagine that the demonstration of the existence of intermediate types is only necessary to establish a developmental hypothesis. Thus Dr. Dohrn (Ann. Magaz. N. Hist., 1868), writing of his discovery of that most interesting genus *Eugeon*, which combines characters of Neuroptera with those of Hemiptera, does not hesitate to say that it proves the truth of Darwin's theory. Now it appears to me that a demonstration of the existence of a regularly graduated succession of types from the monad to man, would be only the minor of a syllogism without its major, in evidence for development, so long as the proof of transition of one step into another is wanting; and the idea that such a discovery could establish a developmental theory is entirely unfounded. Indeed the reasoning in which some indulge—if we dare so call the spurious article—based on this premise alone, is unworthy of science. The successional relation of types, though a most important element in our argument, has been long known to many who give no sanction to the idea of development.

† Entwicklungsgeschichte, 224.

I think that I have already made some progress in proving that the near or true generic relationship is one of absolute developmental repression or advance. Palæontology shows that families and orders, as now existing, were preceded in time by groups which are synthetic or comprehensive, combining the common characters of modern generic series. This process of synthesis must, it is obvious, if continued, result in the near approximation of the single representatives of the now numerous and diverse groups. There is every reason to believe that a backward view through time will show this to have prevailed throughout the vertebrata and other branches, as we already can in part prove. And I have no doubt that the synthetic types, which represent modern orders, have existed in a generic relationship subordinate to the plan of the synthetic class, and that the latter have existed as genera only, of the type of the great branch. This is not ideal. We only have to look to our extinct ganoids, Archegosaurs, Labyrinthodonts, Compsognathus, Archaeopteryx, Ornithorhynchus, etc., to realize these facts.

The first genera then formed a scale of which the members were identical with the undeveloped stages of the highest, and each to each according to their position.

Such a series of antitypic groups having been thus established, our present knowledge will only permit us to suppose that the resulting and now existing kingdoms and classes of animals and plants were conceived by the Creator according to a plan of his own, according to his pleasure. That directions or lines of development towards these ends were ordained, and certain laws applied for their realization. That these laws are the before-mentioned law of RETARDATION AND ACCELERATION; and law of NATURAL SELECTION.

The first consists in a continual crowding backwards of the successive steps of individual development, so that the period of reproduction, while occurring periodically with the change of the year, falls later and later in the life history of the species, conferring upon its offspring features in advance of those possessed by its predecessors, in the line already laid down partly by a prior suppression on a higher platform, and partly as above supposed, by the special creative plan. This progressive crowding back of stages is not, however, supposed to have progressed regularly. On the contrary, in the development of all animals there are well-known periods when the most important transitions are accomplished in an incredibly short space of time, (as the passage of man through the stages of the aorta bows, and the production of limbs in *Batrachia Anura*;) while other transitions occupy long periods, and apparently little progress is made.

The rapid change is called metamorphosis; the intervening stages may be called larval or pupal. The most familiar examples are those which come latest in life, and hence are most easily observed, as in the insects and frogs. When, during the substationary period, the species reproduces, a constancy of type is the result; when the metamorphosis only appears at the period of reproduction a protean type is the result; when the metamorphosis is crowded back to an earlier period of life, then we have another persistent type, but a new genus of a higher grade than its predecessor.

In reviewing many examples everywhere coming under the eye of the naturalist, it is easy to perceive what would constitute a *plastic* and what a *conserved* condition of generic, or even of specific form.

As one or more periods in the life of every species is characterized by a greater rapidity of development (or metamorphosis) than the remainder, so in proportion to the approximation of such a period to the epoch of maturity or reproduction, is the offspring liable to variation. During the periods corresponding to those between the rapid metamorphoses the characters of the genus would be preserved unaltered, though the period of change would be ever approaching.

Hence the transformation of genera may have been rapid and abrupt, and the intervening periods of persistency very long; for it is ever true that the 1868.]

macrocosm is a parallel or repetition of the microcosm in matter and mind. As the development of the individual, so the development of the genus. We may add—so the development of the whole of organized beings.

These metamorphoses may be fitly compared to those in the molecular constitution of matter. The force of cohesion between the atoms of a vapor steadily increases with descending temperature, and in a regular ratio, till a given point is reached, when a sudden metamorphosis to a denser, or liquid condition takes place. Nor have we reason to believe, with regard to many substances, that there is any parallel relation between the temperature and the molecular constitution before or after the metamorphosis takes place. So the temperature continuing to descend, the molecular character of the liquid remains unchanged until the *vis conservatrix* suddenly giving way at the ordained point, a solid is the result. Thus while the change is really progressing the external features remain unchanged at other than those points, which may be called *expression points*.

Now the *expression point* of a new generic type is reached when its appearance in the adult falls so far prior to the period of reproduction as to transmit it to the offspring and to their descendants, until another *expression point* of progress be reached.

Thus a developmental succession does not so obliterate the lines drawn around nature's types as to render our system ineffectual as an expression of them.

The successional acceleration or retardation in metamorphosis may be best illustrated in the cases selected above, by the following tables. These are taken, it will be remembered, from the Bufonidæ and Hylidæ as examples of "exact parallelism;" three are now added from the Ranidæ and Discoglossidæ. The case of "inexact parallelism" is that of the Scaphiopodidæ.

Whether they are cases of acceleration or retardation can only be determined by reference to the palæontology of the respective groups, or a careful comparison of times of metamorphosis. In the case of the Discoglossidæ I suspect it to be retardation, as the highest genus is extinct. The others I shall arrange with them for temporary convenience. Were I dealing with a group of Ganoids, I should imagine the process to be retardation, as this group is going out of existence. On the other hand, were they higher Oscine birds we might imagine the case to be reversed.

TABLE I.

| Assumed, | Series No. 1. No. 2. | | No. 3 | |
|------------|--|--------------|-------------------------|--------------------------------|
| 140th gen. | : | : | Bombinator..Hyla..... | Epidalea. |
| 120th gen. | : | e : | Alytes* | ..... |
| 100th gen. | : | e Pf : F | Discoglossus. | ..... |
| 80th gen. | : | e Pf F : |Scytotis..... | Bufo sp. |
| 60th gen. | : | e. Pf F Ex : |Osteocephalus..... | Bufo sp. |
| 40th gen. | : | Pf : F Ex t | Latonia..... | Trachycephalus.....Peltaphryne |
| 20th gen. | Pf : F Ex t | : | ..... | ..... |
| 1st gen. | ?: | : | ..... | ..... |
| | Hatched | Exostosis. | Temporal roof. | Death. |
| | Persistence andly apparatus (Series 1 only). | | | Reproduction. |
| | Front ossified. | | | |
| | Loose tail. | | | |
| | Prefrontals meet (in series 1 and 3 only). | | | |

* A parotoid gland of small size is added here, but is not generic as compared with Bombinator, as the latter has collections of crypts on the same region and over the body.

In the preceding diagrams each horizontal column represents the life history of the individuals of each genus. The line of dots, stars, etc., represents the same developmental stage of each, as it appears earlier or later in the life of the individuals. The point of crossing the breeding period is that at which the character is rendered permanent. When the change falls on this period the character is not generic, as in *Ixalus*, Tab. II. The period of losing the tail, like that of breeding, is represented as occurring at nearly the same time in the history of every genus, as it is generally seasonal. Yet this is not always so, and like the other characters has most likely had its period of shifting. Compare difference of time of development, for instance, of the frontal and prefrontal bones in Tabs. I. and IV. The comparison of the adult stages of the less developed genera, at the tops of the columns, with the larval conditions of those more fully developed, may be traced in the absence of characters which appear in the latter. I have convinced myself of the accuracy of the above relations by the examination of many skeletons and wet preparations of adults and larvæ.

The tables* are representations of nature, and not ideal sketches. It is to be noted as remarkable, that the advance throughout so many diverse groups is in the same direction, viz., to complete or excessive ossification of the cranium; and this identity of progress might be readily shown by adding other characters, were it not that the tables would become too complex for convenience.

Has any such transition from genus to genus ever been seen to occur?

It must of course take place during the life of the individuals of a species, and probably at different times during the lives of different individuals, dependent on their relative vigor. In our view, ordinary metamorphosis is such a change, and we have stated its bearing in this form, that "every character distinguishing suborders, families and genera is to be found among the individuals of some species, living or extinct, to mark new varieties or stages of growth."

a. The developmental relation of generic to specific characters.

For the relation of the law of retardation and acceleration to specific characters we will look to development again. While the young of *Trachycephalus* are successively different genera, they preserve most of their specific characters so as not to be mistaken. Agassiz says of the development of the North American turtles,† "I do not know a turtle which does not exhibit marked specific peculiarities long before its generic characters are fully developed." The same thing can be said of the characters of our salamanders, whose specific marks appear before their generic, or even family characters. I suspect that this will be found to be a universal law.

It also follows, if a developmental process, as proposed, has existed, that at times the change of generic type has taken place more rapidly than that of

* Notes on the tables.—I. I characterized a genus *Zaphrissa* (Journ. A. N. S., 1866) from the Braunkohle (miocene) of Prussia, as different from *Latonia*, on the ground of the presence of a fontanelle in the exostosed frontoparietal bones. This combination of characters is very improbable, and appeared so at the time; but the appearance of the specimen is quite clear in this respect. I think, however, it must be the result of injury, and that the roof has been partially carried away.

Tab. II. Polypodates is here restricted to *P. maculatus* and *P. quadrilineatus*. The other species are referred to *Rhacophorus*, which has not hitherto rested on any proper basis; the asserted character—the palmation of the hands—being one quite graduated from species to species among *Hyla*. *Chiromantis*, Peters, is referred to the same, as its character is not strongly marked and is visible in other species. For similar reasons *Leptomantis* is referred to *Ixalus*.

Tab. IV. In each of series II and III two series are mingled for the sake of comparing the structures of the prefrontal bones. Thus *Heteroglossa*, *Staurois*, *Hylorana* and *Tryphlops* are one series, and *Hyperolius* and *Hylambates* members of another.

† Contrib. N. Hist. United States, I., p. 391. Note.

specific, and that one and the same species (if origin be the definition,) has, in the natural succession, existed in more than one genus.*

Apart from any question of origin, so soon as a species should assume a new generic character it ceases, of course, to be specifically the same as other individuals which have not assumed it. If supposed distinctness of origin be, however, a test of specific difference, we shall then have to contend with the paradox of the same species belonging to two different genera at one and the same time.

It follows, therefore, in our interpretation of nature, that groups defined by coloration alone are not to be regarded as genera, as is done by some ornithologists and entomologists. They are simply groups of species in which distinctive generic characters had not appeared up to the period of reproduction. Inasmuch as in development certain specific characters appear first, among them part or all of the coloration pattern, it is obvious that the latter do not belong to the generic category. The employment of such characters then, in this sense, is only to commence reversing the terms generic and specific, and to inaugurate the process of regarding each species as type of a separate genus. •

β. Of probable cases of transition.

Thus the transition between the toothed and edentulous conditions in Cetacea takes place in the ordinary growth of the individuals of the genus *Globiocephalus*, and the transition between the ossified and non-ossified types of *Chelonia* occurs during the life of the individuals of the genus *Dermatemys*.

But in attempting to demonstrate this proposition we must bring forward facts of another kind. The anti-developmentalists are accustomed to put such changes aside, as part of the necessary history of established types; hence we will not appeal to such.

1. The frog *Ranula affinis*, of South America, was described by Peters as probably a climatal variety of European *Rana temporaria*. In this he is supported by the fact that the specific characters do not differ more than would characterize it as a local variety, were it an inhabitant of Europe. But I have found that it differs generically in the non-ossification of the ethmoid bone, as has been confirmed by Steindachner, and represents an embryonic condition of the same bone in *Rana*. It is in fact an undeveloped *Rana*. That this is a true genus is confirmed by many specimens, by an additional species (*R. palmipes*), and by the fact that the allied genus *Tryphlopsis*, embracing three species in the same region, differs in the same way from the otherwise identical genus of the Old World, *Hylorana*.

2. The South African Saurians *Chamæsauro anguina*, and *Mancus macrolepis*, are very closely allied in specific characters in all respects, though distinct. They have one important ground of generic distinction; the latter has one pair of limbs less than the former. They are rudimental in *Chamæsauro*, and the disappearance in *Mancus* is but another step in the same direction. The difference in specific characters is of much less degree.

3. In the genus *Celestus* there are numerous species, which range from a slender, snake-like form with weak limbs, to stouter, strong-limbed forms with a more saurian build. Among these the Haytian *C. phoxinus* is well distinguished by form and coloration. An allied genus from the same region is *Panolopus*, which in specific characters approaches the *C. phoxinus* very closely, much more so than any *Celestus* (one species possibly excepted). But in generic characters it is distinguished by the loss of all its toes and the non-separation of nine plates on the end of the muzzle. The genus *Diploglossus*, on the other hand, occupying a superior place on account of the division of the frontonasal into three, is, in specific characters (of *D. monotropis*) much

* See Proceedings Academy, 1867, p. 86, where I observe that generic characters are probably less inherent than specific.

closer to the stout *Celesti* than the species of the latter genus are among themselves.

4. The *Gronias nigrilabris* is a Silurid, which in specific characters more nearly resembles the *Amiurus lynx*, than the latter does the *A. albidus* and many other species of the genus. The *A. lynx* is found in the same streams. The important generic character, the absence of eyes, is, however, its constant feature (in three specimens known to naturalists, others to fishermen).

5. The *Cinclidium granulatum*, a large tree toad of Brazil, resembles in all its characters the *Centrolerma geographicum*. The specific differences between them amount to almost nothing, but both sexes of the former grow larger and are furnished with a generic peculiarity in the addition of some phalanges to the thumb.

6. The Auk *Sagmatorrhina suckleyi* Cass. is stated* to resemble in plumage and all its characters the *Ceratorhynchamonocerata*, as to be not distinguishable, even as a variety from it, except by the striking generic characters. In the latter a concave bone-like process rises from above the nostril, and an accessory piece is found in the symphysis mandibuli, both wanting in the genus *Sagmatorrhina*.

7. The *Oporornis agilis* Baird, a North American bird of the Tanager family, resembles very closely in form, color and habits, the adjacent species of the adjacent genus *Geothlypis*. While its specific characters are thus very close to *Geothlypis tephrocotis*, it differs in the generic feature of a longer wing. By this it is associated, and properly so, with another species, *O. formosus*, which has the general color and habits of species of *Myiodiodes* (*M. canadensis*), the next related genus.

8. The following fact I give on the authority of Prof. Leidy, who will publish it in his forthcoming work on the extinct mammalia of Nebraska, etc.

Three species of *Oreodon* occur in the miocene strata; they are a larger, a medium and a small sized species. In the Pliocene beds above them they are represented by three species of *Merychys*, which are in all respects known, identical specifically with the three preceding. Each one may thus be said to be more nearly allied to the species of the other genus than to its fellow of the same genus, in specific characters. But each, on the other hand, differs from each in generic characters. The teeth of *Merychys* are more prismatic, have longer crowns and shorter roots, approaching the sheep, as *Oreodon* does the deer.†

9. The North American Centrarchoid, *Hemiplites simulans*, in specific characters is most closely allied to the *Enneacanthus guttatus* Morris.* It has however one or two distinctive specific features, but it differs as to genus in having one less dorsal spine and one more anal spine, characters in the direct line of succession of genera to *Centrarchus* and *Hyperistius*. Now the lack of one of its dorsal spines is not an uncommon variation in the *Enneacanthus*, but the anal is never known to change. There is, however, apparently no reason, as far as physical causes are concerned, why it should not tend to vary as much as the dorsal. The lack of this tendency constitutes *Hemiplites*, a genus distinct from *Enneacanthus*, at the present time.

* By Coues Monograph of Alcidæ. Proc. Acad. Phila., 1863, p. 34.

† This phenomenon suggests an explanation on the score of adaptation, which the other cases do not. The existence during the later period of a tougher material of diet, would increase the rapidity of wearing of the crown of the tooth, and require a longer crown and greater rapidity of protrusion. This necessitates a diminution of the basal shoulder and shortening of the roots, producing the prismatic form aforesaid. The deer browses on forest foliage, which is more tender, while the *Carioctenia* grass the grasses, which contain, as is known, a greater amount of silex; hence the more rapid attrition of the tooth.

This may have been the case with the two extinct genera; the different periods during which they lived may have seen a change from forest to prairie. (It is not intended to insinuate that the species of the two genera are necessarily of the same or any given number.)

Those naturalists (who are not a few) who will be disposed on this account to deny generic rank to Hemiploites, will have, on the same grounds, to unite each succeeding step till they embrace the "series," and no doubt at the same time belie a considerable amount of their own work already done.

10. The *Coreopsis discoides* T. and G., var. *anomala* Gray, is much more nearly allied to *Bidens frondosa* than to other species of its own genus, and the latter is nearer to it than to other species of *Bidens*. It differs chiefly, if not altogether, in the generic character: the barbs of the achenia are directed upwards; those of the *Bidens* downwards.

From these and many other such instances it may be derived: *That the nearest species of adjacent genera are more nearly allied in specific characters than the most diverse species of the same genus.*

11. While *Taxodium distichum* and *Glyptostrobus europæus*, conifers of North America and of Eastern Asia, respectively, are readily distinguished by generic peculiarities of their cones; in specific characters they appear to be identical.*

Confirmatory of this proposition is the statement of Parker:† "In tracing out the almost infinite varieties of the modifications of any one specific type of shelled Rhizopod, my friend, Prof. Rupert Jones and I found that *like varieties of distinct species are much nearer in shape and appearance than unlike varieties of the same essential species.*" (It is not unlikely that species should here be read genus and variety species, though the latter may not fulfil the requirements in regard to distinctiveness observed among higher animals. In types like the Rhizopod, forms of this grade may not be really differentiated. Their enormous geographical range would suggest this, if nothing else.)

Objection.—A class of objectors to the preceding explanation of the relations in question, will ascribe them to hybridization. They have already done so to considerable extent among the Teleosts, (see the writings of Von Siebold, Steindachner and Günther). That hybrids exist in nature will be denied by none, but that they are usual or abundant is not a probable condition of a creation regulated by such order as ours is. The tendency to modify in given lines of generic series, if admitted, will account for many of the cases regarded as hybrids by the above authors, for it is to be remarked in many cases how the generic characters are strikingly affected, and are chiefly used in guessing at the parentage. This is among Cyprinidæ so much the case that their is scarce an example of a hybrid between two species of the same genus brought forward, but often between species of different genera.

If any two forms should hybridize freely, the circumstance should prevent their recognition as distinct species.

γ *Ascertained cases of transition.*

This naturally suggests that in accordance with the theory of acceleration and retardation, a transition can take place in the life history of species. Have we any means of proving this suspicion?

1. The genus *Ameiva* (Saurians of South America) has been composed of species of moderate size furnished with acutely tricuspid teeth. *Teius*, on the other hand, embraces very large species with the molars obtusely rounded and of the grinding type. These genera are generally held to be well founded at present. I find, however, that in *Ameiva pleii*, which is the largest species of the genus, that in adults the greater part of the maxillary and mandibular teeth lose their cusps, become rounded, then obtuse, and finally like those of *Teius*. While young, they are true *Ameivæ*. Strangely enough the *A. pleii*, from Porto Rico, acquires but three such obtuse teeth when of the size of the other (*St. Croix*) forms. In youth the teeth of all are as in other *Ameivæ*. Here is a case of transition from one genus to another in the same species.

* See Meehan, Proc. Amer. Ass. Adv. Sci. 1868. Newberry, Ann. Lya., N. Y., 1868.

† Transac. Zool. Soc., London, 1864, 151.

2. In the important characters of the possession of branchiæ, of maxillary bones, and of ossified vertebræ, the tailed Batrachia presents a series of a rising scale, measured by their successively earlier assumption. Thus *Salamandra atra** produces living young, which have already lost the branchiæ; *S. maculosa* living young with branchiæ; *Plethodon*† produces young from eggs which bear branchiæ but a short time, and do not use them functionally; *Desmognathus nigra* uses them during a very short aquatic life; *D. fusca* and other Salamanders maintains them longer, while *Spelerpes* preserves them till full length is nearly reached. Finally species of *Amblystoma* reproduce while carrying branchiæ, thus transmitting this feature to their young as an adult character. And it is a very significant fact that *Spelerpes*, which bears branchiæ longest, next to *Amblystoma*, is associated in the same zoological region with a genus (*Necturus*) which differs from its four-toed form (*Batrachoseps*‡), in nothing more than the possession of the osseous and branchial characters of its larva, in a permanent and reproducing condition. That this is a genus, to be one day converted into *Batrachoseps* by an acceleration of its metamorphosis, or that has been derived from it by the reverse process, I am much inclined to believe. In support of this I quote the following examination into the time of change of the species of *Amblystoma* from my Essay on that genus.§

"The great difference between the different species, and between individuals of the same species in this respect, may be illustrated by the following comparison between the size of the animals at the time of losing the branchiæ so far as known, and that to which they ultimately attain.

| Species. | Size at loss of branchiæ. | | Average full size. | |
|----------------------------|---------------------------|---------------------|--------------------|--------|
| | In. | Lines. | In. | Lines. |
| <i>A. jeffersonianum</i> , | 1 | 5.75 | 6 | |
| <i>A. punctatum</i> , | 1 | 10 | 6.1 | 6 |
| <i>A. conspersum</i> , | 1 | 10.5 | 2 | 7.5 |
| <i>A. opacum</i> , | 2 | 2 | 3 | 9.5 |
| <i>A. texense</i> , | 2 | 1 | ? | |
| <i>A. microstomum</i> , | 2 | 3.5 | 4 | |
| <i>A. talpoideum</i> , | 3 (perhaps too large) | | 3 | 9.5 |
| <i>A. paroticum</i> , | 3 | 7.5 (not smallest.) | 7.2 | 2.5 |
| <i>A. tigrinum</i> , | { 3 | 7 to | 3 to 10 | |
| | { 6 | 7 | | |
| <i>A. mavortium</i> , | { 3 | 9.5 to | 8 | 9 |
| | { 8 | 0 | | |
| <i>A. mexicanum</i> , | ? branchiæ persistent. | | 8 | |

The last species, though not uncommon in collections, is not known to pass through its metamorphoses in its native country, but reproduces as a larva, and is therefore type of the genus *Siredon* of Wagler, Cuvier, Owen and others. The larva of *A. mavortium* in like manner reproduces, but their offspring have in the Jardin des Plantes and at Yale College undergone an early metamorphosis.||

Here is a case where all the species but two change their generic characters; one changes them or not, according to circumstances, and one does not change them at all. What are the probabilities respecting the change in the first set of species?

* See Schreibers Isis, 1833, 527: Kœlliker, Zeitschr. f. Wissensch. Zoologie, ix, 464.

† Baird Iconographic Encyclopedia, Wyman, Cope.

‡ See Cope, Journ. Ac. Nat. Sci., Phila., 1866.

§ Proceed. Academy, 1867.

|| Through the kindness of Prof. Dumeril, I have received both larvæ and adult of the species here noted, and observed by him. The larva is as he states, *Siredon lichenoides* of Baird, while the adult is his *Amblystoma mavortium*, not *A. tigrinum* (= *larvæum*) as also supposed by Dumeril.

As we know from the experiments of Hogg, Duméril and others that metamorphosis is greatly hastened or delayed by the conditions of temperature and light, what would not be the effect on such a protean species of a change of topographical situation, such as the elevation or depression of the land? And I have no hesitation in saying that if the peculiarities of series of individuals of *A. tigrinum* and *A. mavortium*, in the respects above enumerated, were permanent, they would characterize those series as species, as completely as any that zoologists are accustomed to recognize. For the evidences on this head, see the discussions of those species in my monograph.

The experiments of Hogg above alluded to, are as follows, as given by him in the *Annals and Magazine of Natural History*.

He placed a number of impregnated ova of frogs in vessels arranged at regular distances from the light, in a cave. The lessening degrees of light were of course accompanied by a corresponding but much less rapid decline in temperature. The resulting effects on the metamorphosis may be tabulated as follows :

| Mo. | day. | 60° | 56° | 53° | 51° |
|-----|------|-------------------|------------------|----------------|--------------|
| 3 | 11 | Egg. | Egg. | Egg. | Egg. |
| | 20 | Larva free, | * | * | * |
| | 25 | * | Larva free, | * | * |
| | 31 | * | * | Larva free, | Larva free, |
| 4 | 10 | Larva very large, | * | * | * |
| | 22 | Metam. complete, | Larva large, | Larva large, | Larva small, |
| 8 | 11 | | Metam. complete, | * | * |
| | 28 | | | Metam. complt. | ** |
| 10 | 31 | | | | Metam. comp. |

3. The reproduction of some species of insects before they complete their metamorphosis is a well-known fact, and it is particularly to the point that, in many of them, some individuals do attain to their full development, while the many do not. Westwood says,* "two British species of this family (the Reduviidæ), *Prostemma guttula* and *Coranus subapterus*, are interesting on account of their being generally found in an undeveloped state, the latter being either entirely apterous or with the fore-wings rudimental, although occasionally met with having the fore-wings completely developed. "I think," says Spinola, "that the presence of wings and their development depends on the climate," and in speaking of *Oncoccephalus griseus*, he says "the influence of the northern climate appears to have arrested the development of the organs of flight." It will be seen that I have referred elsewhere that I have noticed that it is especially in hot seasons that certain species acquire, while the circumstance noticed respecting the ordinary occurrence of winged specimens of *Microccelia* in the West Indies is confirmatory of the same opinion."

4. It is now known that certain Orthoptera do not get through their metamorphosis in time for the period of reproduction, and hence never or in rare instances only develop more than a short distance beyond the pupa state.

5. My friend, P. R. Uhler, tells me of an example among Hemiptera of the genus *Velia*. The species *V. rivulorum* Fab., and *V. currens** of Europe, are only distinguished by the developmental feature of the presence of wings in one, and their absence in the other. Another species of the tropical region of the West Indies, *Halobates americanus* Uhler, is furnished with wings, while its individuals which occur abundantly in North America have been generally supposed to lack them. Individuals, however, no doubt occur whose developments is so far accelerated as to permit them to acquire wings before the period of reproduction, since one such has been found by Uhler.

* Uhler informs me that Amyot's asserted color characters are not reliable.

These wing characters are in many cases generic, it appears to the writer; and the fact that they differ without corresponding specific differences, is important evidence as to the origin of genera.

6. The females of the Lepidopterous genus *Thyridopteryx* never develop beyond the pupa state, according to the same authority, before reproduction; they are reproducing pupæ, so far as the external characters concerned in metamorphosis go. In other words, the latter have been retarded, while the reproductive system and others have progressed. Now generic characters are seen in the first, not in the last. The influence of the males is sufficient to prevent more than a part of the offspring from being retarded in the same manner.

I have selected a few of this class of facts which have come before my mind during the present writing, as drawn mainly from my own experience. How many more of the same purport could be found by search through the great literature of science or in the field of nature, may be readily imagined. I have no doubt that the field of Entomology especially will furnish a great number of evidences of the theory of acceleration and retardation, especially among the insects with active pupæ.

Finally, having already stated the law according to which these processes naturally take place, I quote the following significant language of Hyatt in the above quoted essay on the Cephalopoda, as approaching nearer to the "law of acceleration and retardation," than any thing I have found written. He says:

"In other words there is an increasing concentration of the adult characteristics of lower species, in the young of higher species, and a consequent displacement of other embryonic features, which had themselves, also, previously belonged to the adult periods of still lower forms."

The preceding propositions have been formulated as follows; a few additions being now made:

I. That genera form series indicated by successional differences of structural character, so that one extreme of such series is very different from the other, by the regular addition or subtraction of characters, step by step.†

II. That one extreme of such series is a more generalized type, nearly approaching in characters the corresponding extreme of other series.

III. That the other extreme of such series is excessively modified and specialized, and so diverging from all other forms as to admit of no type of form beyond it.‡

IV. That the peculiarities presented by such extremes are either only in part, or not at all of the nature of adaptations to the external life of the type.§

V. That rudimental organs are undeveloped or degraded conditions of the respective characters developed or obliterated in the extreme of the series.

VI. That the differences between genera of the same *natural* series are only in the single modifications of those characters which characterize the extreme of that series.

VII. That the relations of the genera of a primary series, are those of the different steps in the development of the individuals of the extreme genus *ab ovo* (*Von Baer, Agassiz*) (with sometimes the addition of special adaptive features??)

VIII. That the presence, rudimental condition, or absence of a given generic character can be accounted for on the hypothesis of a greater rapidity of de-

* On Insects, II, 473.

† St. Hilaire, Owen, Agassiz, Duméril.

‡ Dana on Cephalization; Leconte.

§ Owen on Cotacea, Trans. Zool. Soc., Lon., 1866, 44. Leconte on Carabidae, Trans. Amer. Philos. Soc., 1863, 364.

velopment in the individuals of the species of the extreme type, such stimulus being more and more vigorous in the individuals of the types as we advance towards the same, or by a reversed impulse, of development, where the extreme is characterized by absence or "mutilation" of characters.

IX. And that as the character of the genus at the period of reproduction of its species, is that which is perpetuated;

X. So the character of the genus has been first inferior, then protean, and then advanced, as the metamorphosis has been by a retrograde movement in time, posterior to, at, or anterior to the period of reproduction.

XI. That it therefore results that there is one primary structural type involved in such a series of species, which is made to present at any given period in its Geologic history that appearance of succession of genera ordained by Creative Power.

2. On the origin of *inexact parallelism*.

The hypothesis can only be demonstrated in case of *exact parallelism*. If proven in these, it readily accounts for the cases of *inexact parallelism*, which are of course in any single period vastly in the majority. First take the case of *simple inexact parallelism*. A series of individuals of the genus *Didocus* undergo the metamorphosis of the cranial structure earlier and earlier in life, commencing by completing the ossification of the perichondrium of the frontoparietal region in full age, until at last it becomes completed as early as the period of reproduction. Heretofore the adult offspring have appeared during a long period, invariably characterized by the larval cranium, but like now producing like, this development springs into new power, and the offspring ossify the cranial bones far earlier than their immediate predecessors; in a word, the genus *Pelobates* has been created! At this state of progress *Didocus* is an undeveloped *Pelobates*.

Let us, however, suppose the "acceleration" of development of the cranial bones still to progress. The character appears now soon after the ordinary metamorphosis has been passed, and now a little before. The identity of *Didocus* with the undeveloped *Pelobates* is thereupon lost!

So may have been the relations between *Pelobates* and *Cultripes*. *Pelobates* was probably once identical with the undeveloped *Cultripes*, but the same acceleration has concentrated the characters more rapidly than the other larval stages, leaving *Pelobates* behind.

This I conceive to be the explanation of this relation: when the parallelism is *inexact* by two steps, as in *Spea* to *Didocus*, by the obliterated ear and ossified xiphisternum. The continued concentration of characters has been carried to earlier stages till the identity exists in the adult state of neither one, but at a period of larval life of both, shortly preceding the adult period of the lower. The relations between the *Amblystomidæ* and *Plethodontidæ*, which I have elsewhere* pointed out, have probably had their origin in this way.

If we attempt to prove the identity of the modern mammalian fetal circulation with that of the modern adult fish, we may find nearly an exact parallel in this respect, as it is the basis of class distinction; but in other respects the identity will not exist, rendering the parallel *inexact* or remote. The structure of the origins of the aorta is at one time identical with that of the shark, with one exception—in the former but four aorta-bows appear together; in the latter five. In the former the first disappears as the fifth comes into being. This is simply a continuation of *acceleration*. The first generalized representative of the *Mammalia* lost the first aorta-bow towards the latter part of its growth, and became the next genus in advance of the selachian. The fact that these bows do not appear exactly simultaneously, but rather successively, renders it necessary that in a regularly shortening period of possession of

* Jour. Ac. Nat. Sci., Phil., 1866, 100.

transitory characters, one such, as the existence of the first aorta root, should vanish before the appearance of a permanent, the fifth, in the more specialized types, where acceleration reaches its maximum. This is indicated by the fact that in the Batrachia, where the acceleration has not attained so high a degree, the first and fifth aorta-bows coexist for some time, though the first and second disappear before maturity.

So also with the splitting of the bulbus arteriosus. As in the Batrachia, the pulmonary *ductus communis* only is to be separated, the remaining bulbus is divided by a long valve or incomplete septum, tracing the division of the aorta roots. In the serpent (Rathke), this division is so accelerated as to appear at nearly the same time as the septum of the pulmonary duct. In the mammal, on the other hand, while the division of the aorta root takes place as soon as in the last, the pulmonary septum is accelerated so as to appear long before the first named. Hence in the septa in the serpent, the singular anomaly seems to present, of the mammal passing through the Batrachian stage while the serpent, a nearer relative, does not.* If, however, we take the less typical serpent, we will find the aortic septum to appear a little later, thus giving the Batrachian type, and if we reverse the order of time, so that the succession becomes one of retardations, we will find the same known ratio will bring us to an identity under all circumstances.

This then is the explanation of the divergence and want of "exact parallelism" which is observed in comparing the developmental histories of all types *not most closely allied*. It has not, according to our theory, *always been a divergence*, but was at a prior epoch in each case a relation of "exact parallelism," the lower type a repressed higher; the former identical with one of the stages of the latter. But the process which has produced this relation, continued, has of necessity destroyed it, so that the exact parallelism has always been a temporary relation, and one shifting over the face of the system.

III. Of higher groups.

First; comparison of the cotemporary.

Having now admitted a developmental succession of genera, and second, that this has progressed more rapidly at certain times in the earth's history than any modification of specific forms, the hypothesis already broached naturally comes up. *Has such transformation of types, generic or higher, taken place in any degree simultaneously, throughout a great number of species?* An affirmative answer to such a proposition is absolutely necessary to its acceptance as expressing the phenomena exhibited by geological succession of types. Let us try to answer the question put in a closer form. Have the same species been transferred from one geologic epoch to another by a change of generic form; and has not the genus been transferred from one epoch to another under change of ordinal type? and as a consequence the same species?

As a reply, I propose to render the affirmative of the first of these questions highly probable.

Paleontology only will be able to answer this question conclusively, though as we have abundant evidence that the relations of species to genera and other higher groups were the same then as now, we may look to the present status as furnishing important evidence on the subject. We are turned at once to the probable history of development in the separate zoological areas of the earth's surface. The question may be asked, Are the present zoological regions on an equal plane as to the geologic relations of their faunæ, or are they related as the different subdivisions of a geologic period in time?

I have on a former occasion asserted that the latter of these propositions was true.†

*This is the way indeed in which it is stated by Rathke, *Entwicklungsgeschichte der Natur* p. 164.

† On *Arciferous Anura*, Journ. Ac. Nat. Sci., 1866, 108.

a. Of homologous groups.

Naturally following the admission of a developmental succession of organic beings, is the question of its relation to the different surfaces of land and water on the earth. The following considerations bear on this subject.

Among the higher groups of animals can be detected series "homologous" on the same principle as the alcohols (? compound radicals) and their derivatives; and the component types of each can be, and have been in many instances, shown to be "heterologous," as are the ethers, mercaptans, aldehydes, acids, etc. Among Mammalia two partly homologous series have been pointed out, Implacentalia and Placentalia;* possibly such are the types Altrices and Pracœoces among Aves; of a lesser grade in this class are the parallel series of Pullastræ and Gallinæ, of Clamatores and Oscines. Among Tortoises I have alluded to the Pleurodira as compared with the remainder of the order, already parallelized by Wagler; and of lesser grades, the series among Lacertilia of Acrodonta and Iguania, parallelized by Duméril and Bibron, and of Teidæ and Lacertidæ, compared by Wiegmann. I have discovered a full parallelism between the Raniform and Arciferous Anura. It is carried out between the Characini and a group of remaining Physostomous Fishes, perhaps not yet well defined; it is exhibited between the orders Diptera and Hymenoptera among insects. None of these comparisons can be allowed, of course, without the most searching anatomical and embryological analysis.

This *heterology* is what Swainson and others called "analogy" as distinguished from affinity. It *generally* relates genera of different zoological regions. Mimetic analogy, on the contrary, relates genera of the same region; it is a superficial imitation which has occurred to critical biologists, and is of much interest, though as yet but little investigated. It has as yet been observed in external characters only, but occurs in internal also; it has been accounted for in the first case by the supposed immunity from enemies arising from resemblance to well defended types. No such explanation will, however, answer in the latter case. I believe such coincidences express merely the developmental type common to many heterologous series of a given Zoological "Region;" this will be alluded to a few pages later.

We naturally inquire, is there anything in the food, the vegetation, or the temperature to account for this apparent diversity in the different regions? Are there not carnivora, herbivora, seed-eaters, insectivores, and tree climbers, where game and grass, seeds and insects and forests grow the world over? We answer undoubtedly there are, and these adaptations to food and climate are indeed as nothing in the general plan of creation, for every type of every age has performed these functions successively.

β. Of Heterology.

This relation will be exhibited by a few examples from groups known to the writer, commencing with the Batrachia Anura.

| | RANIFORMES. | ARCIFERI. |
|-------------------------------|------------------|---------------|
| External metatarsal free. | | |
| Aquatic. | Rana. | Pseudis. |
| Metatars. shovel. | Hoplobatrachus. | Mixophyes. |
| External metatarsal attached. | | |
| | Feet webbed. | |
| Metatars. shovel. | Pyxicephalus. | Tomopterna. |
| Arboreal; vom. teeth. | Leptopelis. | Hyla. |
| " no " " | Hyperolius. | Hylella. |
| Subarboreal. | Hylambates. | Nototrema. |
| | Feet not webbed. | |
| Terrestrial. | Cassina. | Cystignathus. |
| " spurred, | Hemimantis. | Gomphobates. |

Comparing the genera in a general physiological sense we may parallelise further.

| | |
|------------------------------------|---------------|
| Aquatic, with digital dilatations. | |
| Heteroglossa. | Acris. |
| Arboreal; cranium by-perostosed. | Polypedates. |
| Trachycephalus. | |
| " cranium free. | Rhacophorus. |
| | { Hyla. |
| | { Agalychnis. |

The same kind of parallels exist between the primary groups of the Testudinata, as follows:

| CRYPTODIRA. | PLEURODIRA. |
|---|----------------|
| Five complete pairs of bones across the plastron. | |
| Pleurosternidæ. | Sternotheridæ. |
| Four pairs of bones across plastron; not more than two phalanges on all toes. | |
| Testudinidæ. | Pelomedusidæ. |
| Three phalanges on most digits; | |
| Zygomatic arch; no parieto-mastoid. | |
| Emydidæ. | Podocnemididæ. |
| Temporal fossa overroofed by parietal. | |
| Macrochelys. | Podocnemis. |
| No zygoma; a parieto-mastoid arch. | |
| * * * | Hydraspididæ. |

If we compare the peculiarities of generic structure merely with reference to their adaptation to the animals habits, we will see the following:

| CRYPTODIRA. | PLEURODIRA. |
|--|---------------|
| Feet reduced for terrestrial progress. | |
| Testudinidæ. | Pelomedusidæ. |
| Feet normal. | |
| Anterior lobe of sternum moveable. | |
| Cistudo. | Sternotherus. |
| Cinosternum. | |
| Anterior lobe fixed. | |
| Neck very elongate. | |
| Trionychidæ. | Chelodina. |
| Neck shorter; aquatic. | |
| Temporal fossa open. | |
| Emydidæ in gen. | Hydraspididæ. |
| Temporal fossa over-roofed. | |
| Cheloniidæ. | Podocnemis. |

The parallels between the genera of the American Iguanidæ and the old world Agamidæ are similarly quite close.

| IGUANIDÆ. | AGAMIDÆ. |
|---|------------------|
| Abdominal ribs. | |
| Polychrus. | * * |
| No abdominal ribs. | |
| Ribs greatly prolonged into a lateral wing. | |
| * * | Draco. |
| Ribs not prolonged. | |
| Arboreal types, generally compressed. | |
| A dorsal and caudal fin supported by bony rays. | |
| Basiliscus (no fem. pores) | Lophura (pores.) |
| No vertebral fin. | |

[Oct.

| | | |
|--|------------------------------|------------------------------------|
| No femoral pores. | | |
| Form slender, scales in equal series, | Calotes. } Bronchocela. } | Lamantcus. |
| Form elongate; eyebrows elevated, tail compressed. | Gonyocephalus. | Ophryoëssa. |
| Form stouter, scales less regular. | Hypsibates. | Tiaris. |
| Femoral pores. | | |
| Low crested; small hyoid disk. | Brachylophus. | Diporophora. |
| High crested; large hyoid disc. | Iguana. | Physignathus. |
| Tail with spinous whorls. | Cyclura. | * * |
| Terrestrial types of flattened form. | | |
| Femoral pores. | | |
| Tail with whorls of spiny scales. | Hoplocercus. | Uromastix. |
| Tail long, simple; scales small. | Crotaphytus. | Liolepis. |
| Tail simple, scales large. | Sceloporus. | * * |
| No femoral pores; preanal pores. | | |
| Tail with whorls of spines. | * * | Stellio. |
| Tail simple, not elongate, ear open. | Proctotretus. | Agama. |
| Neither femoral nor anal pores. | | |
| Much flattened, tail short, scales irregular. | | |
| Ear exposed. | Phrynosoma. | Moloch. |
| Ear concealed. | (Doliosaurus, s. g.) | { Phrynocephalus. Megalochilus. |

A similar parallel may be drawn between the American Teidæ, and the old world Lacertidæ, and in fact between all the families of the Lacertilia Leptoglossa. I have added to these for comparison two families of the Typhlophthalmi. Each family embraces one or more series, and these exhibit a remarkable similarity in the relative development of the limbs and digits; among the higher groups the parallelisms lie in the arrangement,—as greater or less separation, of the head shields. The Scincidæ are cosmopolite; the Gymnophthalmidæ, which have the eyelids of their fœtus, are Australian; the Sepsidæ, either larval or senile in head shields, are mostly Ethiopian.

The first comparison of these groups was made by Wiegmann (Herpetologia Mexicana,) who employed, however, only the Scincidæ and Lacertidæ, and could not include the many types made known since his day.

From the class Aves I have selected only the homologous series of the Clamatorial and Oscine Passeres. Naturalists more fully acquainted with the genera could probably increase the examples of heterology largely. Each group furnishes us with carnivorous, insectivorous and frugivorous forms; each with walkers, climbers, and sedentary genera; each with butcher-birds, thrushes, warblers (not in song!), wrens and fly-catchers. Each and all of these types are teleologically necessary to any country complete in the wealth of nature, and to each geological period.

1868.]

| | <i>Lacertidae.</i> | <i>Tetide.</i> (no <i>supranasale</i> .) | <i>Anguilla.</i> | <i>Gymnophthalmidae.</i> | <i>Batrachia.</i> | <i>Serpentes.</i> | <i>Pyrophi-</i> <i>idae.</i> | <i>Acontistidae &</i> <i>Anelytropidae.</i> |
|-----------------------------------|--|--|---|---|--|---|--|--|
| Two pair limbs. I. Toes 5-6. | | | | | | | | |
| A. Scales granular. | <i>Lacerta.</i> | <i>Ameiva.</i> <i>Chamaeleon.</i> | | | | | | |
| | <i>Eremias.</i> | | | | | | | |
| B. Scales imbricate. | <i>Notopholis.</i> | | | | | | | |
| Supranasale. | | | | | | | | |
| Prefrontals 2 (divided.) | <i>Gerrhonotus.</i> | <i>Centropyx.</i> | <i>Diploglossus.</i> | <i>Morethia.</i> | <i>Euprepis.</i> <i>Eumeces.</i> | <i>Amphiglossus.</i> <i>Sphenops.</i> <i>Gongylus.</i> | | |
| Prefrontals 0. | <i>Pleurostichus.</i> | | <i>Celestus.</i> | | | | | |
| No supranasale. | <i>Platyosaurus</i> <i>Cicign.</i> | <i>Cercosaura.</i> <i>Iphisa.</i> <i>Epicrionus.</i> <i>Lepidosoma.</i> | | <i>Cryptoblepharus.</i> <i>Ablepharus.</i> | <i>Cyclodus.</i> <i>Himilia.</i> <i>Mocia.</i> | | | |
| II. Toes 4-5. | | <i>Tritonocincus.</i> (<i>Acrantus</i> .) | | <i>Menetia.</i> | <i>Campodactylus.</i> <i>Rutella.</i> <i>Heteropus.</i> | | | |
| III. Divided 3-3 to 2-3 times. | <i>Sauropsis.</i> | <i>Brachypus.</i> | <i>Saurisia.</i> | <i>Gymnophthalmus.</i> | <i>Tetradactylus.</i> <i>Chlamela.</i> | <i>Sepalia.</i> <i>Anisolema</i> , (3-4) | | |
| IV. Divided 1-2 or 2-1 or 2-2. | | <i>Chalcia.</i> | | <i>Micula.</i> <i>Blepharactis.</i> | <i>Anomalopus.</i> <i>Siaphus.</i> <i>Hemiergus.</i> <i>Chelomeles.</i> | <i>Sepa.</i> <i>Heteromeles.</i> <i>Sphenoccephalus.</i> <i>Sepomorphus.</i> | | <i>Nessia.</i> |
| V. One limb divided. | | | | <i>Lerista.</i> | | | | |
| VI. Neither divided. | <i>Cetia.</i> <i>Chamaesaura.</i> | <i>Ophiogommon.</i> | <i>Panolopus.</i> | | | | | |
| One pair limbs. | <i>Manatus.</i> | | <i>Pseudopus.</i> | | | | | |
| No limbs. | | | <i>Ophiodon.</i> <i>Ophiosaurus.</i> <i>Anguis.</i> <i>Ophiomorus.</i> | | <i>Sordida.</i> | <i>Scalotes.</i> | <i>Pygopus.</i> <i>Delma.</i> <i>Pletholax.</i> <i>Aprasia.</i> | <i>Herpetosaurus.</i> <i>Acontia.</i> <i>Typhlosaurus.</i> <i>Pygopus.</i> <i>Anelytropus.</i> |

[Oct

OLAMATORES.

OSCINES.

I. Tree-climbers, with long hind toe and tail feathers stiffened and acute.

Dendrocolaptidæ.

Certhiidæ.

II. Terrestrial in part, with the tertials as long as the primary quills.

Geobatidæ.

Motacillidæ.

III. Tree-perchers with hooked bill, graduating from powerful to medium and slender.

Formicariidæ.

Turdidæ.

Thamnophilus.

Bill strongest, hooked.

Lanius.

Formicarius.

" moderate.

Turdus.

Formicivora.

" weak.

Sylvia.

Rhamphocœmus.

" slender (wrens).

Troglodytes.

IV. Fly-catchers with flat bill and weak legs; wait for their prey and take it on the wing.

Tyrannidæ.

Muscicapa et aff.

V. Flat-billed berry and fruit eaters.

Cotingidæ.

Bombycillidæ.

From the Mammalia the well-known series of the Marsupialia and Placentalia may be chosen.

PLACENTALIA.

MARSUPIALIA.

I. Toes unguiculate, in normal number; sectorial teeth; i. e., one or more molars with one or no internal tubercles; canines strong:

Carnivora.

*Sarcophaga.**

I. Digitigrade.

Toes 5—4.

b. Numerous sectorial tuberculars.

Tubercular molars $\frac{3}{2}$.

Canidæ.

Tubercular molars $\frac{4}{4}$ (upper incisors more numerous in some).

*

*

*

*

II. Plantigrade; molars tubercular.

Thylaciniidæ.

a. Posterior molars $\frac{4}{4}$.

*

*

Dasyuridæ.

aa. Posterior molars $\frac{3}{2}$.

Ursidæ.

*

*

II. Toes unguiculate; molars with more than one row of pointed tubercles; canines weak or none; incisors large.

Insectivora.

Entomophaga.

a. True molars $\frac{4}{4}$, toes 4—5.

Tail naked.

Gymnura.

Didelphys.

Tail hairy.

Cladobates.

Myoictis.

IV. Molars with transverse crests, no canines; tusk-like incisors; pairs of limbs of similar proportions.

* Flower and Kneff show that the supposed carnivorous Thylacoleo Ow. is allied to *Hypsiprymus*, and probably similar in habits.

Proboscidea.

Two inferior incisors; molars with two cross-crests; size huge.

- * * a. Two rudimental lateral incisors above. *Diprotodon.*
 aa. ? One pair of incisors only above; a trunk.

Dinotherium.

V. No canines; two pairs of cutting incisors.

a. Three true molars.

Rodentia.

- * * aa. Four true molars.

Rhizophaga.

The parallels are in this case very imperfect in details, and but few worthy of the name can be made. They are, however, illustrative of a remote heterology, sufficiently remarkable to have claimed the notice of naturalists for many years.* I also have little doubt but that future paleontological discoveries will increase the number of parallels, but bring to light truly heterologous generic terms of the Marsupial series. Predictions of this kind have been on many occasions fulfilled (*e. g.*, some of D'Orbigny's among the Cephalopoda), and I look with confidence to the ultimate demonstration of that heterology here, which has been already seen in the Batrachia and Reptilia.

The homologous groups of the Catarrhine and Platyrrhine Quadrumans are measured as follows:

| | <i>Catarrhini.</i> | <i>Platyrrhini.</i> |
|-------------------|-----------------------|---------------------|
| Tailless. | <i>Andropithecus.</i> | * |
| | <i>Simia.</i> | * |
| | <i>Hylobates.</i> | * |
| Tail short. | <i>Cynocephalus.</i> | * |
| | <i>Macacus.</i> | <i>Brachyurus.</i> |
| Long tail. | | |
| Thumb developed. | <i>Cercopithecus.</i> | <i>Lagothrix.</i> |
| | | <i>Mycetes.</i> |
| Thumb rudimental. | <i>Semnopithecus.</i> | <i>Brachyteles.</i> |
| Thumb none. | <i>Colobus.</i> | <i>Ateles.</i> |

I append two homologous series, represented by the Nautilia and the Ammonites of the Tetrabranchiate Cephalopoda, which are distinguished, the first by the simple septa and the siphon central or marginal ventral; and the second by the complex and folded septa and siphon central or marginal dorsal. The parallelisms have been noted by Barrande, Bronn, and many conchologists, who can furnish a much more full table than the following, from the most recent sources:

| <i>NAUTILI.</i> | <i>AMMONITES.</i> |
|---|-------------------|
| A. The shell straight, unwound. | |
| Orthoceras. | <i>Baculites.</i> |
| B. The shell more or less curved or wound. | |
| a. Simply curved. | |
| Cyrtoceras, } Phragmoceras, } | <i>Toxoceras.</i> |
| aa. A more or less straight portion, folded on the remainder. | |
| β. Folded portion in close contact with remainder. | |

* We owe very many observations on the Marsupials to Owen.

| | | |
|--------------|--|---------------|
| Ascoceras. | | Ptychoceras. |
| ? | $\beta\beta$. Folded portions not in contact. | Hamites. |
| | ? | |
| | $\alpha\alpha\alpha$. One extremity spirally wound, the volutions not in contact. | |
| | β . Extremity of the shell prolonged beyond the wound portion. | |
| Lituites. | | Ancylloceras. |
| | $\beta\beta$. Extremity not prolonged in a line. | |
| | γ . The spiral flat. | |
| Gyroceras. | | Crioceras. |
| | $\gamma\gamma$. The spiral elevated (heliciform). | |
| Trochocerus. | | Turrillites. |
| | $\alpha\alpha\alpha\alpha$. Spiral turns of the shell in contact. | |
| | β . Extremity prolonged in line beyond the spiral. | |
| * | * | Scaphites. |
| | $\beta\beta$. Extremity not prolonged beyond spiral. | |
| Nautilus. | | Ammonites. |

We may now consider the question of the origin of these higher groups. In the first place, we must lay down the proposition *that the characters which constitute groups "higher" in the comparison of rank (we do not of course mean higher in the same line, as we say higher genus in a family, or higher order in a class) are such solely from their being more comprehensive, or present throughout a greater range of species.*

What is true, therefore, in respect to characters of genera, is likely to be true in respect to characters of higher groups, such as we have been considering in the preceding pages. Believing, then, that a new genus has been established by the transition of a number of species of a preceding genus in order, without necessary loss of specific characters, I think the same process may have established the suborders and orders in question. That is, *that a large number of genera have near the same time, in past or present geological history, passed into another suborder or order by the assumption or loss of the character or characters of that to which they were transferred, and that without necessary loss of their generic characters.*

I will cite a probable case of this kind, the facts of which I have already adduced.

It has already been shown that the genera of six of the families of the Batrachia Anura form series characterized by the successive stages of ossification of the skull, terminating in a dermoossified condition, with over-roofed temporal fossæ. That in nearly all the other families similar relations between genera exist, but are nowhere carried so far. The character attained by all the first series is now only generic, but should all the genera of each of the six families assume this character in time, as is necessary in accordance with a development hypothesis, it would at once possess a new and higher importance, and would become ordinal or otherwise superior. It would define a series homologous with all those types which had not attained it. This character of the over-roofing of the temporal fossæ has actually attained a family significance among the Testudinata,—*s. g.*, as defining the marine turtles; and similar characters are found by Owen to characterize the Labyrinthodontian order of Batrachia.*

Agassiz has pointed out a similar and more extended case, in the Heterocercal and Homocercal ganoids. Had we not so many of the closest approximations between members of these groups, they would stand in the systems

*The roof here alluded to by Owen includes some two distinct bones not known in the arch of the Anura, and therefore different. It is, however, enough to know that this structure is serially associated with its absence and rudimental appearance in the tailed Batrachia of the present day, to make the comparison apposite.

as two great homologous series, with their contained heterologous genera. As it is, these heterologous terms or genera are evidently so nearly allied that Agassiz, in the *Poissons Fossiles*, has thought it best to arrange the latter together, thus instituting a system *transverse*, as it were, to the other. This may be necessary, since K  lliker points out transitional forms, and perhaps certain types may have begun to abandon the heterocercal form near the period of reproduction, producing offspring somewhat protean in character, preparatory to an earlier appearance and consequent permanence of the homocercal type. This is to be derived from the history of the metamorphosis of *Amblystoma*.

In the same manner the development of the convolutions of the brain does not define groups of the highest rank, since it progresses chiefly during the latter periods of embryonic life, and is therefore a "developmental character." Owen has endeavored to distinguish the primary divisions of *Mammalia* by the character of these convolutions, whereas they really define only the sub-groups of the orders. For we have *Lissencephalous* (smooth-brained) monkeys,—certain lemurs,—and smooth-brained *Ruminants*,—i. e., the extinct *Brachyodon* and *Anoplotherium*, according to Lartet and Gratiolet. (The lowest types of the existing smooth-brained *Mammalia*, including especially those with no or rudimental corpus callosum, the *Marsupials*, are also distinguished by the non-development of the deciduous teeth* (excepting one premolar). If now through some topographical change the whole series of *Mammalia* between the smooth-brained and convolute-brained were lost to us, as by the elevation of a region, and the absence of favorable localities or bodies of water for the preservation of their remains, we would have to study two homologous groups, with the heterologous terms of each corresponding with each other, as do now the genera of the *Clamatores* and *Oscines*, of the *Arctifera* and *Raniformia*, etc.

In the same way the characters defining *Implacental Mammalia* will be found transitional in some type, and this great series, homologous with the *Placentals*, will have to be placed in closer connection, in its genera, with the series of the latter, with genera of the same, perhaps now extinct.

γ. Of mimetic analogy.

It has been often remarked that the animals of the Equatorial Ethiopian region were very generally of smoky and black colors. This is remarkably the case, and the peculiarity of the genus *Homo* in this respect is shared by birds, reptiles and fishes in a remarkable degree. This cannot be traced to the effect of torrid climate, for the same latitudes in India and the Malaysian Archipelago, and in South America, do not produce such colors.

The similarity in color of desert types has also been remarked. The grey sand-hue so well adapted for concealment is universal, with few variations, in the reptiles of the Tartar and Arabian deserts, the great Sahara, and the sands of Arizona and California. There is also a tendency to produce spiny forms in such places; witness the *Stellios* and *Uromastix* and *Cerastes* of the Sahara, the *Phrynosomas* and horned rattlesnake of south-western America. The vegetation of every order, we are also informed, is in these situations extremely liable to produce spines and thorns.

The serpents of the Neotropical Region furnish remarkable illustrations of mimetic analogy. All the species of the genera *Elaps*, *Pliocercus*, *Oxyrhopus*, *Erythrolamprus*, and many of those of *Ophibolus* and *Rhabdosoma* are ornamented with black and yellow rings on a crimson ground. The species of all these genera are harmless, except in the case of *Elaps*, which is venomous. We may give for this genus, as the most varied, the following range of variation in coloration:

* This I have inadvertently alluded to (p.) as the non-development of the permanent series; the homology of the dental system of *Marsupials* appears, however, to be with the latter, and not with the milk series. See Flower, *Trans. Roy. Soc.* 1867.

| <i>Pairs of black rings ;</i> | <i>Single black rings, far apart</i> | <i>Single black rings, very close</i> |
|--|---|--|
| | Elaps corallinus. b nigrocinctus. c Pliocercus equalis. c | Elaps mipartitus. d Pliocercus euryzonus. d |
| Opheomorphus mimus. d | Oxyrrhopus ? | Oxyrrhopus petolarius. d |
| Erythrolamprus venustissimus. a | Erythrolamprus albostriatus. b | Scolecophis zonatus. a |
| Ophibolus polyzonus. a | | Leptognathus anthracops. a |
| Xenodon bicinctus. b | | |
| <i>Single black rings with faint laterals.</i> | <i>Black rings in threes.</i> | <i>Single black rings about equal to intervals.</i> |
| Elaps fulvius. elegans. a | Elaps lemniscatus. b | Elaps. Pliocercus dimidiatus. a Catostoma semidoliatum. a |
| Pliocercus elapoides. a | Oxyrrhopus trigeminus. b | Oxyrrhopus sebæ. d Ophibolus pyrrhomelas. h Chionactis occipitale. h Sonora semiannulata. h Contia isozona. h Chilomeniscus ephippicus. h |

Species a, from Mexico and Central America.

" b, " Brazil, Venezuela.

" c, " Central America.

" d, " western side of Andes.

" h, " Arizona and Sonora.

Many of the species in the same column are exceedingly similar, and some have little (perhaps nothing) to distinguish them but generic characters. The most similar are almost always from the same sub-region.

Similar analogies have been pointed out by Bates among the Lepidoptera of Brazil, and by Wallace among those of Borneo and Celebes, etc. I call attention to these authors here without copying them, as they will repay perusal in the originals.

A case of analogy which may belong to this class is that of the three genera *Chelys* among tortoises, *Pipa* among frogs, and *Aspredo* among Siluroid fishes, species of which inhabit at the same time the rivers of Guiana. The crania of these genera are similarly excessively flattened and furnished with dermal appendages, and their eyes are very minute. The singular similarity need only be mentioned to those familiar with these genera, to be recognized.

The bearing of the Mimetic analogy on the question of transition of types in the developmental hypothesis, is its demonstration of the independence of generic and specific characters of each other, which may suggest the possibility of the former being modified without affecting the latter.

These facts might have been introduced under Sect. IIa, but they illustrate the general laws of the present section.

IV. Of natural selection.

a. As affecting ordinal and class characters.

The second law which may be supposed to have governed a descent with modification, in the production of existing genera, is the force which the will of the animal applies to its body, in the search for means of subsistence and protection from injuries, gradually producing those features which are evil-1868.]

dently adaptive in their nature. This is part of the "natural selection" of Darwin.

That this law is subordinate to the one first propounded must, I think, be evident to any one who studies the assumed results of the workings of both, as seen in the characters of genera. It is sufficiently well known that the essential features of a majority of genera are not adaptive in their natures, and that those of many others are so slightly so as to offer little ground for the supposition that the necessity has produced them.

Both laws must be subordinate to that unknown force which determines the direction of the great series. If a series of suppressions of the nervous and circulatory systems of beings of common birth produced the "synthetic" predecessors of the classes of vertebrata, the direction towards which the highest advanced, or its ultimate type, can be only ascribed as yet to the divine fiat. So far as we can see, there is no reason or law to produce a preference for this direction above any other direction.

If from these fixed bases descendants have attained to successive stations on the same line of progress, in subordinate features of the nervous and circulatory systems, constituting the "synthetic" predecessors of the orders in each class, the type finally reached seems to rest on no other basis than the pleasure of the Almighty.

β. As affecting family characters.

If from the single species generalizing a modern order we attempt to deduce synthetic predecessors of existing families, we find some difficulty, if we attempt to see in these stages a uniform succession of progress. A suppression of some features, and advance in others, in one and the same individual up to the period of reproduction, would produce offspring divergent from the start, and represent the relationship of families as we find them.

γ. As affecting generic characters.

If the extremes of our series of genera were characterized by structures particularly adapting them above all others to some cotemporary necessity of existence, this second law, or Darwin's, might be regarded as primary. But the writer's experience of comparative anatomy has led him to believe that this is not the case, as expressed in Proposition IV.

This view has not been overlooked by Darwin, who, however, treats of it very briefly, and appears to attach it to the theory of adaptations, or modifications for a physiological purpose. He says, *Origin of Species*, 388 (Amer. Edit. 1860): "We may extend this view to whole families, or even classes. The fore-limbs which served as legs in the parent species may become, by a long course of modification, adapted in one descendant to act as hands, in another as paddles, in another as wings; and on the above two principles,—namely, of each successive modification supervening at a rather later age, and being inherited at a correspondingly late age,—the fore-limbs in the embryos of the several descendants of the parent species will still resemble each other closely, for they will not have been modified. But in each individual new species the embryonic fore-limbs will differ greatly from the fore-limbs in the mature animal; the limbs in the latter having undergone much modification at a rather late period of life, and having thus been converted into hands, paddles or wings." He then inclines to assign this change to the necessity of external circumstance. But such modification must be the same in kind as others, which the same hypothesis must explain, and of which the same author remarks (p. 382): "We cannot, for instance, suppose that in the embryos of the Vertebrata the peculiar loop-like course of the arteries near the branchial slits are related to similar conditions in the young mammal, which is nourished in the womb of its mother, in the egg of the bird which is hatched in a nest, and in the spawn of a frog under water. We have no more

[Oct.

reason to believe in such a relation than we have to believe that the same bones in the hand of a man, wing of a bat, and fin of a porpoise, are related to similar conditions of life. No one will suppose that the stripes on the whelp of the lion, or the spots on the young blackbird, are of any use to these animals, or related to the conditions to which they are exposed."

The law of natural selection, however, has no doubt been a very important agency in the production of organic types in different periods of the world's history, but the part it has played in the determination of generic features would appear to have been very small.

In its first effect,—that of producing a structure adapted for a particular purpose,—it would seem to have acted differently to produce the same results, and hence not to have produced any of the more extended groups, as families, where hundreds of species are identical in a single feature. Witness the differences in diverse types of the tree-frogs, each type adapting its possessor to an arboreal life:

- | | |
|---|--|
| I. Claw-like, with globular base..... | HYLIDÆ. <i>Leptopelis.</i> |
| II. Simple, obtuse-depressed at tip..... | RANIDÆ. I aa and III a. |
| III. With a terminal transverse limb..... | RANIDÆ. <i>Hylarana</i> et aff. <i>Callula.</i> <i>Brachymerus.</i> <i>Hylodes.</i> |
| IV. Bifurcate..... | <i>Batrachyla.</i> <i>Dendrobates.</i> <i>Polypedates.</i> <i>Rhacophorus.</i> |

The short foot of the Testudinidæ, where one row of phalanges is omitted, has been already alluded to. The gradual reduction of this set of bones, accompanying general modification of form in the increased convexity of dorsal region, as we leave the more aquatic and progress towards the terrestrial tortoises, would seem to be intimately connected with difference of habit. The increased convexity of carapace is an increased defence from falling objects,—a danger to which land tortoises are far more subject than the aquatic. Another protection not needed by water tortoises so much as by terrestrial, is the faculty of closing one or both free lobes of the plastron, as seen in the Cistudo, Sternotherus, etc., or of portions of the carapace, as in Pixys, Cinixys, etc. This might really have been produced by excessive tension on the sternal and pelvic muscles while young, and while the sutures were not fully interlocked. This, continued for a long time, might have produced the result. Yet it is not easy to see what protection the aquatic Urodon and Platystrophia need in this respect, above the Emydes of the same countries. The backs of these genera are also as convex as are many of the terrestrial genera or Testudinidæ.

I cannot better express my views than by quoting the following from the pen of the late Dr. Falconer. It is extracted from one of his essays on the Elephantidæ.*

"Each instance, however different from another, can be shown to be a term of some series of continued fractions. When this is coupled with the geometrical law governing the evolution of form, so manifest in shells of the Mollusca, it is difficult to believe that there is not in nature a deeper seated and innate principle, to the operation of which natural selection is merely an adjunct.

"The whole range of the mammalia, fossil and recent, cannot furnish a species, which has had a wider geographical distribution, and, at the same time, passed through a longer term of time and through more extreme changes of climatal conditions than the mammoth.

*See writings of Hugh Falconer, vol. II. (Ed. by Murchison.)

"If species are so unstable and so susceptible of mutation through such influences, why does that extinct form stand out so signally a monument of stability? By his admirable researches and earnest writings, Darwin has, beyond all his cotemporaries, given an impulse to the philosophical investigation of the most backward and obscure branch of the biological sciences of his day; he has laid the foundation of a great edifice; but he need not be surprised if, in the progress of erection, the superstructure is altered by his successors, like the Duomo of Milan, from the Roman to a different style of architecture.

"The inferences which I draw from these facts are not opposed to one of the leading propositions of Darwin's theory.

"With him I have no faith in the opinion that the mammoth and other extinct elephants made their appearance suddenly, after the type in which their fossil remains are presented to us. The most rational view seems to be, that they are in some shape the modified descendants of earlier progenitors. But if the asserted facts be correct, they seem clearly to indicate that the older elephants of Europe, such as *E. meridionalis* and *E. antiquus*, were not the stocks from which the later species, *E. primigenius* and *E. africanus* sprung, and that we must look elsewhere for their origin. The nearest affinity, and that a very close one, of the European *E. meridionalis*, is with the miocene *E. (Loxod.) planifrons* of India, and of *E. primigenius* with the existing Indian species.

"Another reflection is equally strong in my mind, that the species by 'natural selection,' or a process of variation, from external influences, are inadequate to account for the phenomena. The law of Phyllotaxis, which governs the evolution of leaves around the axis of a plant, is nearly as constant in its manifestation as any of the physical laws connected with the material world."

§. As affecting specific characters.

As I have hitherto attempted to prove, that the higher grade of groups, or, in other words, the higher grade of characters, could not have had their origin through natural selection alone, though admitting it as a conserving or restricting principle, I now come to ground where natural selection must be allowed full sway. The "origin of species" is not the object of this essay, as a greater has gone before me, and has done a great deal towards showing that a selective power, dependent on adaptation and teleological relation, has favored or repressed, or even called into existence, the varied peculiarities that characterize species and races. I will therefore only refer to his well known works on the Origin of Species and the Modifications of Animals under Domestication.

I may add that it is within the range of possibility that that grade or kind of characters found to define the *family* group, may be more or less the result of natural selection.

Acceleration and retardation is also far from excluded from the probable causes of specific characters. The species of many genera do exhibit a proportion of characters which are the successive stages of that one which progresses farthest, as the species of *Amblystoma* in the position of their teeth, nostrils, form of tail and coloration; of *Hyla* in form of vomerine teeth, etc. But the majority of specific characters are of divergent origin,—are "morphic" as distinguished from developmental.

α. On metaphysical species.

One of the arguments employed against the developmental hypothesis in any form, is that that inherent "potentiality" which causes that like shall always produce like, is a metaphysical being, which cannot be transformed, and which holds the structure which it vivifies as a material expression or stamp of itself, and which therefore cannot be changed.

[Oct.

One expression of this inherent metaphysical specific individuality, if the term may be allowed, has been said to be the peculiar traits of the intelligence of species, their motions, voices and instincts. But intelligence of all animals is susceptible of impressions, the lower the intelligence the less susceptible, and the more automatic. But as we rise in the scale of animal being this impressibility and capacity for education is undeniably exhibited by the dog, horse and all the well known domesticated companions of man. There can, in view of the capacities of Aves and Mammalia in these respects, be little doubt that all animals are educated by the "logic of events," that their intelligence, impressed by changed circumstances, can accommodate itself more or less to them, and that there is nothing in this part of their being opposed to the principle of "descent with modification."

There is another difficulty in the way of accepting metaphysical peculiarity or progenitiveness as isolating species. It is marked often strongly in races or varieties, which no one pretends to have had distinct origin. Here like produces like continually, though not persistently, but sufficiently to show that it resides in varieties of common origin. The isolation of allied species in fact depends, we believe, solely on the supremacy of the automatic over the intelligent spirit. When the intelligent rises above the bounds of nature, or the automatic, the mixture or separation of allied species depends merely on circumstances of necessity, determined by that intelligence.

But the metaphysical "potentiality" loses all basis, if the law of acceleration and retardation be true, for in accordance with it, in the fullness of times like does not produce like.

V. Of Epochal Relations, or those measuring Geologic Time.

If it can be shown that groups having the developmental relation above insisted on are cotemporaries, and if it can be shown that this relation is identical in kind with that which we regard as measuring the successions of geologic time, we will be led to doubt the existence of any very great interruptions in the course of this succession throughout geologic time. And if we can show that faunæ so related are more or less characteristic of distinct portions of the earth's surface, at the present time, we will be led to anticipate that cotemporaneous faunæ in different regions, during geologic periods, also bore such a relation. If this proposition be true, we are led to the further conclusion, which is at variance with received canons, that identity of faunæ proves successional relation in time, instead of synchronism.* That this will ultimately be demonstrated appears highly probable to the writer, though, as yet, the evidence is but fragmentary.

If the relations expressed under the terms homology and heterology, taken together with the observations on metamorphosis, render it probable that a number of genera have reached their *expression points*, or periods of metamorphosis, at near the same time in geologic history, an important point has been gained. If we can render it probable that a change in any organic character has been nearly simultaneous throughout a large extent of specific forms, the change becomes, on the latter account alone, of higher than generic value, but characteristic of such groups as Marsupialia, Clamatores, Acrodonta, Arcifera, Heterocerca and the like.

We have here, also, an important element in the estimation of the value of apparent interruptions in the geological history of the life of the globe. These interruptions, it is true, are greater than any such theory as the present can bridge over; yet such a theory, if true, lessens their importance. They are in any case well accounted for on the theory of the existence of periods of elevation, during which the life of a given region is necessarily almost entirely lost to us, through lack of means of preservation of their remains.

*This view was first propounded by ——— and has since been reaffirmed by Huxley. 1868.]

We may also compare such extended metamorphoses with those of cosmical matter, such as when, in the course of ages, a primæval vapor has in a short time collapsed to the liquid form, or as when the vast of liquid in turn has shrunk to its solid condition; both alike for ages approaching their change, yet stationary in external relations till the moment of transition has arrived.

The following are the zoölogical relations of the groups already compared:

The most generalized group of fishes of the Regio Neotropica is that of Characins. Its type, in respect to fin structure, which is common to all the Malacopterygians, is that of an undeveloped stage of the Acanthopterygiana, the adipose fin being an undeveloped cartilaginous fin and the cartilaginous fin an undeveloped spinous fin.* It may be said to be the highest among Malacopterygians if we look to the complete oviducts, opercula, jaws, etc., but it is the lowest as removed farthest from the extreme of Malacopterygian peculiarities, as being most generalized or embracing representatives of all the rest, and approaching nearest the types of the past—the Ganoids. For example, Butyrinus and Vastres may be compared with Amia. The family is distributed chiefly in the Southern Hemisphere.

The genus *Orestias*, which Agassiz says is characterized by a feature which exists in the immature state of all other Cyprinodonts,—the absence of ventral fins,—is only found in the Neotropical region.

Of the venomous serpents, the inferior group, the Proteroglypha, belong to the Southern Hemisphere, and the Australian and Neotropical regions almost exclusively embrace by far the greater proportion. Australia contains none other.

The Iguanian lizards are lower than the Acrodont, exhibiting a larval type of dentition, and one characteristic of all lower Sauria and Batrachia. The only acrodont type of Ophiosauria (*Trogonophis*) is Old World.

The New World Teiidae have not the extent of ossified temporal roof that their representatives, the Old World Lacertidae have. So the chiefly Neotropical Anguidæ have the tongue partly of papillose type of their Old World representatives, the Zonuridae, and partly the smooth or scaly type of the cosmopolite Scincidae, which are inferior to them.

The snake-like forms of the families of the Lacertilia *Leptoglossa* greatly predominate in the Southern Hemisphere; also those with undeveloped palpebræ.

The Neotropical type of Testudinata is quite coincident with the family Characinidae in relations. It is, like it, largely distributed over the Southern Hemisphere, and like it may be regarded, in respect to its pelvic peculiarities, as higher than the remaining types, but in its generalized character and relationship to the past periods may be called lower.

The Neotropical type of Batrachia Anura, that is the Arcifera, is lower in developmental characters than the opposed series, the Raniformia; such of the latter as are found in its limits partake in some way of larval incompleteness. The Arcifera are chiefly distributed elsewhere in Australia, where no Raniformia exist.† Those genera of Old World Raniformia of the lowest or toothless group, which display the least development of the cranial bones, as *Brachymerus* and *Breviceps*, are of the Southern Hemisphere—South African.

The Pullastrine birds are a generalized group, inferior to the group op-

* Kner Ueber den Bau der Flossen.

† The *Eucnemis bicolor* Gray would appear to be an exception, were its generic and subordinate affinities truly represented by its name. I have examined the type specimen through the kindness of Dr. Günther, and can state that it is not an *Ixalus* (= *Eucnemis*), and does not even belong to the Raniformia, but is an Arcifer of the family Hyliidae. If it be not a young *Calamita* or *Hyla*, it will be a *Hyla* near the *H. carnea* type.

Günther states that *Hylorana erythraea* has been found at the extreme northern point—Cape York—of Australia. If so, the case is parallel to the occurrence of the Raniform *Rana* in northern South America.

posed to them—the Gallinæ. Their typical forms, like the last, are distributed to the Neotropical and Australian regions: the outliers (pigeons) are not so numerous distributed in the other regions.

The Struthious birds, the most synthetic of the class, belong exclusively to the Southern Hemisphere; as is well known, they chiefly abound in Australia and its adjacent islands, with an abundant outlying type—the Tinamus—in South America.

The penguins, which only of all birds display the divided metatarsus, inhabit the Antarctic regions and Cape Horn.

The Clamatorial type of the Passeres exhibit larval characters in the non-development of the singing apparatus, and the scaled or nearly naked tarso-metatarsus. These are chiefly South American.

Of Mammalia, the placentals without enamel on their teeth, which, in this respect, never reach the full development of the class, whose dentition is also monophyodont, *i. e.*, the Edentata, inhabit only the Southern Hemisphere, and almost altogether the Neotropical region. The implantental Mammalia, also (except in one tooth) monophyodont, which approach birds and reptiles in so many respects, are confined to the Southern Hemisphere, and chiefly, as all know, to Australia.

Of the Quadrumana, the Platyrrhine group is known to be inferior to the Catarrhines: the former presents an entirely embryonic condition of the *os tympanicum*, which is passed by the latter in early age;* it contains also the only clawed genus of the true monkeys. It is confined to the Neotropical. To Madagascar, also of the Southern Hemisphere, and nearest in many ways to the Neotropical, pertain the lowest families of the Quadrumana, the Lemuridæ and Chiromyidæ; the former presenting brains without convolutions, and approaching in many ways the Insectivora; the last imitating, at least, a Rodent.

There are also other reasons for the inferiority of South America. Its deer, which are few, are those which never produce more than the "daguer," or the first horn of the northern Cervus, or those which never get beyond the fourth step in the development of the lower group of R. Neartica.

The Loricariidæ of South America, I am informed by Prof. Agassiz, possess the foetal pupil of the vertebrate type.

If we glance at Coleoptera we find the great predominance of the groups with undeveloped tarsus, the three and four-jointed Trimera and Tetramera, and of the lower group with undeveloped sternum,† the Rhynchophora, in the Neotropical region.

Among Lepidoptera it is known that the most gigantic of the species of the Neotropical region are Noctuidæ (Erebus, etc.), and that in that region this low type of the order reaches its greatest development. The largest forms of the Regio Neartica, as well as Palæarctica, are representatives of the higher type of the Saturniidæ (Attacus, Telea, etc.), while the largest and most powerful of this order in the Palæotropical (Indian) region are the Papilionid forms of Ornithoptera, etc., the generally admitted crown and head of all. Of course other types, both higher and lower, are largely developed in each and all of these regions, and the significance of the above facts is perhaps only to be seen when taken in connection with a large number of others pointing in the same direction.

Two or three comparisons of different faunæ may be brought forward finally. First, returning to the birds, a survey of some of the differences between the birds of Panama, Pennsylvania and Palestine may be made.‡

Tristram noticed 323 species of birds within the range of the ancient terri-

* See Dr. H. Allen, Proceed. A. N. S., Philada., 1867.

† Leconte American Association, 1867.

‡ From the American Naturalist, 1868, by the author.

tory of Palestine. Of these 230 were land and 92 water birds, *i. e.*, *Natatores* and the wading *Cursores*. Of the 230, 79 are common to the British Islands, and 36 of them are found in China, but a small proportion extending their range to both these extremes. Of the water birds, which are always more widely distributed, 55 of the 92 are British and 57 Chinese. Twenty-seven appear to be confined to Palestine and to the immediately adjacent country; the largest of these is a crow.

Taking the 230 land birds at a glance, we find the utter absence of so many of the well known forms that enliven our grounds and forests. The absence of *Tanagridæ* and *Icteridæ* changes the aspect of the bird-fauna at once. What have we here then of nine-quilled *Oscines* to enliven the meadows like our swarms of blackbirds, or fill the tree tops and thickets with flutter like our wood warblers? Nothing; for the twenty-four species of finches, *Fringillidæ*, will but balance our own, though the genera are all different but four, and they the most weakly represented by species. We must look to the higher series, the ten-quilled song birds, for the missing rank and file. While a much larger extent of the Eastern United States possesses fifty species of these types, the little Palestine has already furnished a list of one hundred and twenty-eight.

First, of the crows, which verge nearest *Icteridæ* by the starlings, we have 13 species against five in our district of the United States, and not less than seven of the type genus *Corvus*, to our one common and two rare. Of these, two are of the larger species, the ravens. If we turn to the cheerful larks, we find the proportion again the same; fifteen species for Palestine and one for the whole United States. One congener of our species occurs there; the other genera call to mind the African Deserts and Russian Steppes. *Motacillidæ*, again, ten to one against our fauna. We have two *Tanagridæ* to imitate them, beside the true relative. In swallows we are about equal, and in the forest-haunting *Paridæ*—titmice and wrens—we exceed a little; but the comparison of *Sylviidæ* and *Turdidæ* is most striking. These highest of the bird series, especially made to gladden man's haunts with song, exceed in number all the other ten-quilled *Oscines* together inhabiting Palestine, amounting to seventy-five species. In our corresponding region of the United States nineteen species is the quantum. It is true no mocking bird or wood-robin is known away from our shores, but Palestine has the nightingale, the black-cap and the true warblers or *sylvias*, which, while they glean from shrub and tree their smallest insect enemies, as do our equally numerous small *Tanagridæ*, have much louder and sweeter voices.

Our solitary blue-bird represents the long-winged *Turdidæ*; in the Holy Land there are twenty species corresponding, though none are of our genus. There are indeed but three genera of these two families common to both countries. One of these, *Lanius*, the butcher-bird, occurs here in one new species, in Palestine in six.

Turning now to a lower series, we look in vain for *Clamatorial* perchers; that series which gives us the fierce king-bird and querulous pewee, and which peoples South America with thrush and warbler, and shrike and tree-creeper.

In taking a hasty glance over the lower groups, where the carotid arteries begin to be double, as the *Syndactyli*, we find Palestine too far from the tropics to present us with much array; but in the related *zygodactyles* our forest-crowned continent must claim great preëminence. It has but a solitary *Picus*, while we have eight in the immediate neighborhood of lat. 40°, in our Eastern States.

I will close with the birds of prey. Four swamp-hawks, eleven species of falcons, four kites, and eight native eagles, form a list unequalled in the annals of nobility by any land. There are together thirty-one species of *Falconidæ*, and of *Vultures*, four. The eagles appear to be all common, among them

[Oct.

the most magnificent birds of prey, the imperial and golden species of these creatures.

To the ornithologist acquainted with the fauna of North America, it will thus be readily perceived that, in comparison, the ornis, just examined, possesses more numerous representatives of the higher groups of the birds, and among lower groups possesses chiefly those of superior grade, or lacks them altogether. Let us, however, compare it with that of Central America, where varied surface and temperature offer even greater opportunity for variety, within quite as restricted an area.

The bird fauna has been found by Mesers. Sclater and Salvin to embrace about 385 species, which is 63 more than were mentioned to occur in Palestine, which is open on three sides to the great continent. Eighty of 348 land birds are characteristic of Central America; and those which find their kin limited to the Isthmus and adjoining regions of New Grenada and Equador, amount to about seventy-five more. Twenty-seven is the number not known to extend beyond the boundaries of Palestine; as to the Middle States of our Union, not one species has been shown to be restricted within such narrow limits.

A single species occurs in Europe; this is the fish-hawk, an animal which combines the cosmopolite habit of the sea-bird with the powerful flight of the bird of prey. This is also the only species common to the Panama and Palestine catalogues.

The birds of prey are numerous,—twenty-nine species. Among these there is no true eagle or falcon, and of the nineteen genera but four belong to the fauna of the Holy Land. There is but one species to represent the great grouse family, but, instead, three *families* of their South American imitators, the Pullastræ, instead of the one—that of the Pigeons—slimly represented in Palestine, and in North America as well.

Coming to the closer test of superiority, the Passeres,—those delicate creatures, apparently so dependent on those laws which govern increase and provision, and so affected by the changes that man works in the face of nature,—what do we find? We count 106 distinct species. There are none in Palestine. Of songsters, the Oscines, ninety-six species await man's conquest of the wilderness, to increase in numbers and to display their gifts, while Palestine rejoices in a whole army of them. But the contrast is more remarkable if we analyze these forms. Of the Isthmian Oscines, seventeen only hold the first rank, by virtue of their additional, the tenth primary quill, while this feature marks one hundred and twenty-eight species of Palestine. As we rapidly follow the line to the point where its extreme is manifested, in the family of the Thrushes or Turdidæ, Panama is left but two solitary pioneers of these songsters of the North, while seventy-five species represent the family in Palestine.

The comparison between different faunæ exhibits an apparent gradation in some other groups equally curious. Thus the true Cyprinidæ in the Palearctic region reach a great development, and produce the highest number of teeth on their pharyngeal jaws known, as well as attains the greatest bulk and importance. The number of these teeth is usually seven to five in the inner row; only two or three genera exhibit only four on both. In the Ne-arctic region the number of teeth is almost always 4—4, more rarely 4—5, and very seldom as high as 5—5. The species of the family are excessively numerous, but are, with scarcely any exception, of small size and weak organization. These statements apply to those of the eastern district of the region between the Rocky Mountains and the Atlantic. Similar types occur in the northern region of the Neotropical,—Mexico, but in no great numbers, but with them the lowest form of the family,—viz., *Graßodus* Günther. This form has no teeth whatever on the pharyngeal jaws. Further south the family disappears, its place being supplied by the generalized family of Characinidæ.

I have already alluded to the great variety of the highest or pentamerous carnivorous beetles in the Palæarctic Region. They are extremely abundant in the Nearctic, while the intermediate territory, the Sonoran and Mexican sub-districts, are the head-quarters of the next lower form, the Tenebrionidæ, which have the tarsal joints 4—5. These give place in the Neotropical to the multitudes of the still lower series,—those with the joints 4—4 and 3—3,—Tetramera and Trimera.

The preceding comparisons indicate that an inherent difference between the types of a continent exists at the present time, though the difference is subordinated to a universal distribution of the higher groups throughout the earth. Has this state of things existed for any long period, or is it a result of different progress in the same group since the human period? This brings us necessarily to a consideration of the truths of palæontology, especially of the last periods, which have been already urged by Darwin. Thus the present fauna of Australia was preceded in the postpliocene and pliocene by forms possessing similar peculiarities, and belonging to the same classes. That is by herbivorous and carnivorous marsupials and monotremes, and by Varanid Sauria, all of greater size than their predecessors.

The same fact is well known of the Neotropical region, its present peculiar Edentata having been preceded by giants of the same type in the postpliocene and pliocene.

In the Nearctic region peculiar existing genera, as *Procyon*, *Alces*, *Castor*, *Bos*, *Sciurus*, *Arctomys*, *Lepus*, *Ovibos*, *Sorex*, *Mephitis*, *Felis*, *Ursus*, *Menopoma*, *Aspidonectes*, *Crotalus*, are represented by postpliocene fossils.

The same occurs in the later Palæarctic formations, where *Cervus*, *Bos*, *Canis*, *Mustelidæ*, *Insectivora*, *Vipera*, *Alytes*, *Triton*, etc., are allied predecessors of existing types. In the Palæotropical area a wonderful development of *Elephas* and *Gavialis* preceded the same types of the present.

Prior to these faunæ another state of things has, however, existed. North America has witnessed a withdrawal of a Neotropical fauna, and the Palæarctic the retreat of an Ethiopian type. During the postpliocene in North America, Neotropical genera were to Nearctic as 12 to 29, as the record now stands. In the pliocene beds of Pikermi (Greece) antelopes, giraffes, rhinoceros, hippopotamus, huge manis,* monkeys, monitors, and other genera and species of African relationship are the prevailing forms.

Still earlier, a strong mingling of Nearctic, and more of Neotropical types, abounded in the Palæarctic. The genera *Chelydra*, *Andrias*, *Podocnemis*,† *Platemys*, *Caviiform*, *Psammoryctid* and *Hesperomys*-like *Rodentia*, *Opossums*, and *Raccoon*-like *Carnivora*.

We have, then, three important terms from which to derive a theory of the creation: 1, the existing six faunæ bear in many of their parts developmental relations to one another; 2, they were preceded immediately by faunæ similar to them in each case, but more remotely by faunæ like that now next lower.

On the whole, there can be no doubt of the truth of the generalization, 1st, *That the Southern Hemisphere is a geologic stage behind the Northern Hemisphere in progress*, on account (1) of its perfection in types extinct in the Northern, and (2) inferiority in modern types prevalent in the Northern.

In order, however, to demonstrate this point more fully, let us examine to what extent the higher types exist in the Southern, and lower or ancient in the Northern.

The Percoid fishes and their allies have Australian and South American representatives in their fresh waters, but they are as mere outliers of the great mass in the Northern Hemisphere. The higher type of venomous serpents (*Solenoglyphæ*) occur in both the Ethiopian and Neotropical regions, but they preponderate in the Northern Hemisphere. The higher group of the

* *Ancylotherium*, *Macrotherium*.

† *P. bowerbankii* (*Platemys* Ow.) *P. lævis* (*Emys* Owen).

Saurians (the Acrodonta) abounds in the Æthiopian and Australian regions; they are as abundant in the Indian and Palæarctic regions of the Northern Hemisphere. In the Southern also, by *Uromastix* and the *Rhynchocephalia*, they approach nearest the ancient types of the *Dicynodontia* and the *Crocodylia*. *Lacertidæ*, and not *Teiidæ*, occur in the Æthiopian, but they are but a proportion of the whole, which chiefly exists in the Nearctic.

Raniform and not Arciferous Anura populate South Africa; they, however, form but a small proportion compared with the great series of the Nearctic, Palæarctic and Palæotropical regions. It is, however, superior in Anura to the Nearctic, taken by itself.

Rasorial birds and not Pullastræ are the food species of South Africa; but they do not compare in abundance or size with those of the three regions just mentioned.

Moreover, but few Clamatores exist in either Australia or Æthiopia. The Oscine types are abundant, nevertheless they cannot be compared in abundance with those of the northern regions. It must also be remembered that the migratory capabilities of birds render them less expressive of the true nature of any fauna.

The higher family of the *Quadrupana*, the *Simiidæ*, replaces in Africa the *Cebidæ* of the Neotropical; they are, however, most abundant in the Palæotropical region, in the other hemisphere.

There are two ancient or inferior types of the Northern Hemisphere: first, its Ganoid fishes, the Sturgeons of the Nearctic and Palæarctic, and the Gars of the Nearctic. The latter only have representatives in the Southern Hemisphere, *Polypterus* and *Calamoichthys* in Africa, and so may be said to be equally distributed; but the former are confined to the north. We do not know, however, whether they are of a modern or an ancient type, nor do we know of extinct sturgeons in the Southern Hemisphere. Indeed, the Ganoid series is not well defined or known as yet. If, as Agassiz states, the Siluroids pertain to it, it is cosmopolitan, though least represented in the Palæarctic.

Second, the Tailed or Urodele Batrachia. This order, entirely characteristic of the Northern Hemisphere, is a group which combines characters of Anura with those of the ancient forms, and possesses in its Nearctic types many of low development. The Gymnophidia of the Southern Hemisphere cannot be considered inferior to them. In the possession of this group the Northern Hemisphere presents its first element of inferiority.

The preceding comparisons indicate also the relations of the regions proper to each other. It is obvious enough that the Æthiopian is much superior to the two others of the Southern Hemisphere. As to the Australian and Neotropical, the former must still be regarded as probably the most ancient, though possessing at the same time a much stronger admixture of northern forms. I have already presented the relations, with the inferior forms of each, thus:*

- R. A u s t r a l i s .—Inferior in Monotrematous and Marsupial Mammalia, Pullastriform and Struthious Birds, Serpentiniform Pleurodont Lacertilia, Arciferous Batrachia, Pleurodire Turtles, its Elapid venomous snakes, and the whole Flora, according to Unger.
- R. N e o t r o p i c a .—Marsupial and Edentate Mammalia, Inferior Rodentia and Quadrupana, Pleurodire Turtles, Pleurodont Lacertilia, Arciferous Batrachia, Clamatorial and Pullastriform Birds, Characin and Erythrinid Malacopterygii.

Conclusions.

The following may be looked upon as conclusions which have been indicated in the preceding pages:

- I. Species have developed from preëxistent species by an inherent tendency

* Journ. Acad. Nat. Sci. Philada. 1866, 109.

to variation, and have been preserved in given directions and repressed in others, by the operation of the law of Natural Selection. (Darwin.)

II. Genera have been produced by a system of retardation or acceleration in the development of individuals; the former on preëstablished, the latter on preconceived lines of direction. Or, in other words, that while nature's series have been projected in accordance with the law of acceleration and retardation, they have been limited, modified, and terminated by the law of natural selection, which may itself have operated in part by the same law.

III. The processes of development of specific and generic characters have not proceeded *pari passu*, transitions of the one kind not being synchronous with transitions of the other; and that, therefore, species may be transferred from one genus to another without losing their specific characters, and genera from order to order without losing their generic characters.

IV. And as the heterologous terms of the peculiar homologous groups present an "inexact parallelism" with each other; and as types related by inexact parallelism are each among themselves exact parallels in separate series, whose earliest members present "exact parallelism" with each other, it follows—

V. That the heterologous terms or genera in the later series are modified descendants of those of the earlier series; in other words, that certain groups higher than genera are produced from others of similar high value by "descent with modification."

VI. That the result of such successional metamorphoses will be expressed in geologic history by more or less abrupt transitions, or expression points, rather than by uniformly gradual successions.

Of course, under the conclusion stated in Proposition II, the genus *Homo* has been developed by the modification of some preëxistent genus. All his traits which are merely functional have, as a consequence, been produced during the process. Those traits which are not functional, but spiritual, are of course amenable to a different class of laws, which belong to the province of religion.

Variations in *Taxodium* and *Pinus*.

BY THOMAS MEEHAN.

In some remarks before the Academy on July 14th, in reference to adnation in the leaves of *Coniferæ*, I said that the power to branch was the test of vigor; and with increased vigor came proportionately the power of adnation. I pointed out that this was the universal law through all *Coniferæ*, so far as I had been able to examine them; and that it fully accounted for the specific identity of many forms supposed to be distinct. I went so far as to suggest that *Taxodium distichum*, Richard, and *Glyptostrobus sinensis*, Endl., were no doubt the same thing, because the only difference between the growing plants was in the different degrees of adnation in their foliage; and because with this adnation was the increased power to branch observed in all other cases. The two points, going along together, seemed to indicate that this could not be a solitary exception to so clearly marked a law. I exhibited specimens taken from *Taxodium*, and from *Glyptostrobus*, showing the approach of the two in the manner the theory indicated.

Since then some new facts have come before me confirming this view in a remarkable manner. On the nursery grounds of Mr. Robert Buist, of the Darby Road, near Philadelphia, are a few trees which I supposed to be the *Glyptostrobus*, but which Mr. Buist assured me were many years ago, selected by him from a bed of some thousand *Taxodium* on account of their peculiar appearance. I exhibit specimens from eleven different trees. It will be seen the suppression of the leaf blades or adnation is in exact proportion to vigor, or the power of forming branchlets, and with this increased vigor the *Taxodium* become *Glyptostrobus*, so far as any comparison of leaves and branches can identify anything.

[Oct.

At the conclusion of my paper on the *laws of adnation*, read before the meeting of the American Association for the Advancement of Science, at Chicago, Dr. J. S. Newberry kindly pointed out that, in a fossil state, *Glyptostrobus* and *Taxodium* were often found side by side, but always with so much difference between the scales of the cones that, while assenting to the general principles of the paper, he could not regard these two plants identical. As cones are nothing more than metamorphosed stems and branches, it is not surprising that the same laws of adnation which might operate in making the *Taxodium Glyptostrobus*, and which make them look so very distinct in the different stages of adnation, should also operate on the fruit, and make it appear, when at the widest point of divergence, as really different. It should in fact do so, and instead of the differences in the cones of these fossils being any proof of their specific distinctness, it must be received as a natural sequence of the law I would evolve.

The specimens I now exhibit show at any rate that the *two plants* are identically the same. This granted, it completely refutes the generally received theory, that no one species of Coniferæ inhabits at once the eastern and western worlds.

In my paper on variations in *Epigæa repens*, presented for publication last May, I endeavored to show that "cultivation" and "external circumstances" would not account for variations in form to the extent they usually received credit for; but that there was rather a regular principle of growth in form, as well as in substance, independent of outward agencies, which agencies were calculated quite as much to preserve as to originate the growing forms.

Those accustomed to study chiefly from herbaria, and little from living specimens, have no idea of the great variations from one type which many species present. These comparative differences are often so insensibly blended, that it is only when we meet with some very extreme forms that they attract our attention, and then only to note their extreme differences. Even when noted they are contemned as obstructing classification, rather than welcomed as invaluable aids in resolving the laws of form.

In a recent review of part 16 of *Decandolle's Prodrömus*, which has lately appeared, with the Coniferæ by Prof. Parlato, the reviewer says: "It must be clear to every one that a great number of so-called species are varieties of one strain, doubtless produced by localization in different climatal or natural conditions." (*Gardener's Chronicle*, page 922, 1868.) As this review is understood to be by one who is himself known as a describer of many Coniferæ, which are doubtless varieties of one strain, it may be worth while to point out, in some Coniferæ, that neither climatal nor any external condition has as much to do with variation in form as an innate power of development, independent of either climatal or local causes.

In one of our commonest pines—*Pinus inops*—a very careful comparative examination will show scarcely any two trees to be exactly alike; the habits of the tree, the shade of color, or the length of the leaves, the size or form of the cone, the scales, or the seeds—in some one point a difference may be found which can easily be described in words. When extremes are brought together the differences are quite as great as characterize different species. By descriptions alone they would be fairly entitled to rank as distinct. The mind fails to unite them. It is only the educated eye which perceives their identity. I exhibit two cones from two trees growing on the banks of the Susquehanna, near Harrisburg. One is very long and narrow—three and a half inches in length, by only three-fourths of an inch wide at the base, and the scarcely projecting scales barely spinescent, the other nearly as wide, but only half the length, and with strongly projecting scales and spines. Unless with previous acquaintance of *Pinus inops* in its natural places of growth, a botanist might well be pardoned for considering these distinct species, yet with the multitude of intermediate forms, all under the same external conditions, how can any "localizations" account for the varieties? I have the same ex-
1868.]

perience with *Pinus rigida* and *P. pungens*; and it is doubtless true of other species.

I have noted some interesting variations in *Pinus Banksiana*, which in some way do seem to be connected with location, although I have no doubt that ages of geographical travel from a central point conjoined with the principle of inheritance, might find the natural inherent laws of variation sufficient to account for them. Dr. Gray says, in the last edition of his *Manual of Botany*, it is a shrub or low tree 5 to 20 feet high, giving N. Maine, N. Michigan and Wisconsin, and northward as the localities. I did not collect in northern Illinois, but friends tell me it grows some thirty miles from Chicago, only as a bush. Michaux observes that in Labrador it shows signs of decrepid old age at 3 feet, and in no part of America did he find it over 10 feet. Dr. Richardson, in Franklin's narrative of a journey to the shores of the Polar Seas in 1819—1822, describes it as 40 feet high in favorable situations, but the diameter of its trunk was greater in proportion to its height than in any other pines of the country. Douglass found it to have longer leaves on the Rocky Mountains than elsewhere. In company with Mr. Wm. Canby, I had the opportunity of examining large forests of them growing on the neck of land between Escanaba, on Lake Michigan, and Marquette, on Lake Superior, where we found them just the reverse of Dr. Richardson's experience. Here they were more slender in proportion to their height, not only than any pine of the country, but probably than any pine elsewhere. Most of the trees were from 30 to 40 feet high, remarkably straight, but only from 6 to 12 inches in diameter. We roughly measured one at Escanaba which was about twenty inches in diameter, and perhaps sixty feet high, little shorter than in fact a very fine *Pinus resinosa*, about two and a half feet through, growing near it.

Now these variations have relation to only one particular, that of size; there would no doubt be found others in many respects; but even in this one character no theory of climate or soil will account for them. If a low temperature dwarfs the Labrador specimens, what is to account for the small bushes in Illinois or southern Wisconsin, in lat. 42°? And again, why are these latter in the rich soils of this district so small in comparison with the almost timber trees of a few hundred miles farther north, and in which is usually considered the poorest land of the north-west? Soil and climate may have some influence in aiding variation, but facts show the origin is deeper than these, namely, a native power to change, kept in check only by inheritance and perhaps external circumstances.

I have heretofore reported *Pinus pungens* as growing at Port Clinton; I find it now abundantly on the hills about Harrisburg; so it may be set down as native to the whole interior of the State of Pennsylvania.

Nov. 3d, 1868.

The President, DR. HAYS, in the Chair.

Forty-two members present.

The following paper was presented for publication:

Sixth Contribution to the Herpetology of Tropical America. By Edw. D. Cope.

Dr. Leidy called attention to two singular specimens presented this evening by Mr. Lamborn. They were obtained from the Huronian slates near the Dalles of St. Louis River, northern Minnesota. They bear a strong likeness to large coprolites partially imbedded in portions of slate. They not only have the usual form of coprolites, though flattened, but have an apparent spiral arrangement. Taken from the surface slate, the bodies, where exposed to the air have been more readily decomposed than the slate. A broken surface ex-

[Nov.

hibits a more distinct crypto-crystalline appearance than exists in the slate. Suspecting that they possibly might be of the nature of coprolites, Dr. L. had desired Dr. Genth to analyze part of one. The result was carb. lime 36.5, silica and silicates 59.1, oxide of iron, alumina, etc., 4.4. Though not of vertebrate origin, they may perhaps have been the excrement of some huge invertebrate, which, with all others of the time, are now totally obliterated.

Dr. Leidy further remarked that it was well known that iridescent hues from the surfaces of bodies, independent of thin films, were usually due to amineute striation or parallelism in the arrangement of the elements of structure. Thus is produced the iridescence upon the wings of the house fly and many other insects, that of muscular and tendinous fibres, of pearl shells, artificially ruled surfaces, etc. He has repeatedly observed that the iridescence on the surface of waters was due to the same cause, through myriads of vibrios and bacteria. Under the circumstances he was surprised that authors continue to repeat that the phenomenon of the beautiful play of colors in the precious opal has not been satisfactorily explained. It is evidently due to a regular striated condition of the structure, readily observed by the microscope. The striæ upon brilliant facets examined in a number of opals appear to be about 6000 to the inch. The striæ are probably the pores to which Brewster alludes as being the cause of the coloration of the opal. The brilliancy of labradorite is also due to a regular parallelism in the arrangement of elements of structure.

Nov. 10th.

The President, DR. HAYS, in the Chair.

Forty-two members present.

Nov. 17th.

The President, DR. HAYS, in the Chair.

Twenty-five members present.

Mr. R. P. Stevens made the following remarks on the geology and mineralogy of Venezuela :

Observations made by my party extend two hundred and fifty miles up the Orinoco river from the city of Bolivar, or five hundred from its mouth, and in three directions southwards one hundred and fifty to two hundred miles. In the hydrographical basin of the Orinoco we have seen no other rock than gneiss, gneissoid schists, granite, and other crystalline rocks. The gneiss is granular and lamellar. Its minerals are magnetic iron ore, cupriferous ores, argentiferous galena, and, very sparingly, gold.

We have been able to make out two distinct systems of elevation in this basin; one running N. and S., the other W. N. W. and E. S. E. The former is a low ridge of black, shining, lamellar gneiss, forming a low divide between the Caroni river and the affluents of the Yuruari, or the line of demarcation between the hydrographical basins of the Orinoco and the Essequibo on the west.

Upon the flanks of these rocks abut the gneiss of the Imitaca Mountains, which forms the divide between these two basins on the north.

The remaining system of elevation runs N. E. and S. W., and corresponds with that of the Appalachian system of the United States.

This system is confined, so far as our observations have seen, to the basin of the Essequibo. The rocks elevated by this system are talcose, with quartz veins, quartzite, porphyry, brecciated schists, and aluminous rock of a bluish color, locally known as "bluestone."

1868.]

The basin of the Essequibo is about 900 miles long N. and S., and 600 E. and W. It is the true auriferous field of Venezuela.

Fragmentary knowledge comes in from all known portions of it, showing all its mountains to be gold-bearing.

In the valley of the Mocupio, a small and insignificant tributary of the Yuruary, the greatest amount of exploration has been done. Here has been developed two systems of veins; one running N. E. and S. W., corresponding with the strike of elevation; the other E. and W., corresponding with the strike of talcose rock.

On the method of the formation of gold in the veins, the following observations have been made:

First. Showing that gold must have been placed in the veins at the same time with the quartz matrix, and that these were deposited *pari passu* on both walls of the vein.

Second. Observations show that gold has been redisposed on fissure walls of the quartz.

Third. Observations show that gold has been mechanically mixed with the sulphuret of iron, and that these depositions were made simultaneously with the quartz.

The best known portion of the new gold fields of Yuayana are situated in the canton of Yuruary (formerly a portion of the canton of Upatee), in lat. $7^{\circ} 20' N.$, and long. $65^{\circ} W.$ from Greenwich; about 100 miles south from the island of Piacoa, in the Orinoco river, and 200 miles south-east from Bolivar, over the great plains of Venezuela.

Nov. 24th.

The President, DR. HAYS, in the Chair.

Thirty-two members present.

The chairman of the Curators announced that B. Waterhouse Hawkins, F. G. S., had presented to the Academy a restored skeleton of the *Hadrosaurus Foulkii*, on which the following resolutions were offered and adopted:

Resolved, That the Academy entertain a deep sense of obligation to Mr. Hawkins for his valuable donation of a restored skeleton of *Hadrosaurus Foulkii*,—a gift which will constitute an especial attraction and a prominent object of interest in our museum.

Resolved, That the profound palæontological knowledge, artistic skill and patient industry displayed by Mr. Hawkins in reconstructing from some fragmentary remains this huge creature of a former geological period, has gained for him our respect and admiration, while his invariable courtesy and freedom in imparting knowledge has secured our highest regards.

Resolved, That the Academy fully appreciate the great value of the efforts he is making to popularize science; efforts, the importance of which cannot be too highly estimated. They will tend to benefit the community by expanding the minds of the masses, and by furnishing to them higher and more ennobling subjects for thought than can be afforded by the common pursuits of every-day life. He will also advance science by increasing the number of those who can appreciate the labors of men of science, sympathize in their labors, and secure for them objects of interest which would be thrown aside or destroyed by the ignorant.

Resolved, That the Academy tender to Mr. Hawkins its best wishes for his health, happiness and prosperity.

The following gentlemen were elected members: Wm. M. Dar-
[Nov.

lington, Emil Fischer, M.D., Isaac C. Price, Jos. G. Richardson, M.D., M. W. McAllister.

Prof. H. J. Clark was elected a correspondent.

On favorable report of the Committee, the following paper was ordered to be published:

Sixth Contribution to the HERPETOLOGY of Tropical America.

BY EDWARD D. COPE, A.M.

LOXOPHOLIS RUGICEPS Cope, gen. et sp. nov.

Fam. Eubleopodidæ. The scales imbricate, arranged in oblique rows or quincuncially; the exposed portion triangular, strongly keeled. Prefrontals, frontoparietals, parietals and interparietal plates distinct. Lateral and gular scales like dorsal; ventral broad, smooth; no gular collar, no lateral fold. Toes 5—5, all unguiculate. ? Femoral pores. Eyelid with transparent disc.

This genus differs from *Cercosaura* only in the squamation, which is of a character entirely different from that of any other genus of the group except *Tretioscincus* Cope, where the scales are also arranged after the type of the *Scincidæ*.

Char. specificus.—Tail moderately long, limbs well developed. Canthus rostralis a right angle, lores straight, top of head flat. Two loreals or preoculars between nasal and eye. Four superciliaries. Four supraorbitals. Internasal long as broad, prefrontals largely in contact. Frontal twice as long as broad, angulate before and behind. Fronto-parietals and the large inter-parietal longer than broad; parietals rounded externally. Labials five, long and narrow, third and fourth under orbit, with a narrow series of scales between. Inferior labials five, narrow; a large symphyseal; behind this a still larger mental, behind which follow on each side a row of three large and two small infralabials, of which the first two pairs are in contact. Temporal scales keeled. Auricular opening large, a half disc, the truncation behind. Twenty rows of lance-triangular scales on back and both sides, and four rows of smooth abdominal scales, which are broader than long. Six large præanal plates, five reaching the margin, the two outer narrow, the median short. Scales of the limbs large-keeled. No pores on the femur in the specimen. Caudal scales like those of the back of *Pantodactylus*,—i. e., elongate parallelogrammic, in whorls and keeled; keels stronger below than above. The hind limb laid forwards will reach the wrist of the anterior when appressed. Inner fingers and toes very small; lengths of fingers 1—2—5—3—4; of toes 1—5—2—3—4.

The plates of the top of the head are rugose, with longitudinal striæ, which are not close, and more or less interrupted.

| | In. Lin. |
|--------------------------------------|----------|
| Total length (end of tail lost)..... | 4 5.5 |
| Length head to vent..... | 18 2 |
| “ “ axilla..... | 7.2 |
| “ “ ear..... | 4 |
| “ hind limb..... | 6.6 |
| “ “ foot..... | 3.5 |
| “ fore limb..... | 4.8 |

Color above yellowish-brown, with a narrow blackish band on each side from the upper margin of the meatus to near the end of the tail. A median pair of bands appear near the rump, and continue half the length of the tail, but are very indistinct. The upper and lower labial plates with a continuous transverse black band through the middle of each. Throat, belly and tail below unspotted, yellow.

Habitat.—This Saurian is a native of the Magdalena River region, New Grenada, whence it was brought by Schulte Buckow, naturalist, and presented to 1868.]

our Museum in Philadelphia by J. Carson Brevoort. Specimens of *Tretioscincus bifasciatus* Dum., and *Dendrobates tinctorius* accompanied it.

GERRHONOTUS AURITUS Cope, sp. nov.

This species is distinguished by its strong massive head, with a series of elongato-conic flexible processes above the auricular meatus.

Muzzle flattened, canthus rostralis wanting. Each of the posterior pair of supranasals divided in two, the posterior parts on each side the rhombic internasal. Five supraoculars and five supraorbitals; other plates of the head normal; they graduate into the nuchals by three cross-rows of scales. Temples much swollen, but not angularly. Upper labials eight large and two small; lower labials nine, with two rows of infralabials; the inner of four large scales, the third largest. Side of neck and axilla coarsely granular; above the ear four long conic flexible processes, with two or three shorter below them. Scales of back and belly small for the genus, in sixteen longitudinal and twenty-six transverse series, from nape to groin. They are bony, and strongly but finely keeled. Ventral plates smooth, in 14 longitudinal rows. The lateral fold is slight, and contains about three rows of coarse granules.

The ground color is pea-green, more or less shaded with yellow; the rugosities of the scales everywhere black. Blackish green shades form indistinct Vs directed backwards on the middle of the back. Below yellowish, with dirty green shades. Eyelids and auricular processes yellow. Length to vent 5 in.; to axilla 2 in.; to ear 21.5 l.; to orbit 4.5 l.; greatest width of head 12.5 l. Length fore limb 15.5 l.; of hind limb 20 l.; of foot 10.2 l. The tail is short (3 in. 10.2 l.), and covered with bony scales, but I am not sure it has not been early reproduced.

This, the most singular species of the genus, is only equalled in beauty by the *G. gramineus* m. of Mexico, which it resembles. The latter has larger scales, a longer muzzle, and a much more angulate temporal region; the occiput is also well marked off from the nape by one projecting cross-row behind the postparietal, while there are three in *G. auritus*. Finally, its post-supranasals are not divided. Both these species are allied to the *G. tæniatus* and *G. deppii* of Wiegmann. Gray refers the latter to a genus *Abronia*, but a regular gradation of characters connect them with the other *Gerrhonoti*.

This is one of the Reptilian forms which inhabit the vast forests of Vera Paz, in the neighborhood of the ancient cities of Peten and Coban. Museum Smithsonian, Henry Hague discoverer.

HOLCOSUS BRIDGESII Cope, sp. nov.

This species is near the *H. sexcatus* Günther, having quite the same coloration, that is, dark olive, with a pale vertebral band from the end of the muzzle and a lateral black band from the orbit, which is white-bordered above and below. The superior white line is much interrupted in this species. Top of head brown. below uniform light green. It differs considerably in the scutellation of the head. There is a pair of confluent supra- and prenasals in contact medially, and these are succeeded by a pentagonal internasal, but from this point the squamation is different; thus three plates represent each prefrontal, while some eighteen take the place of the frontal. Behind this point they are too numerous to homologize, except that a small median occipital is surrounded by series of tubercular or keeled scales, which are arranged in curved series running behind the occipital. The frontal scales are in three series, two larger superciliaries which are strongly keeled, and a median flat row, with those of the muzzle arranged quite as in species of *Anales*. Supra-orbitals two on each side, each a half-ellipse, keeled on the inner margin, surrounded by granules except the anterior, which is in contact with the superciliaries.

The throat fold is covered with granular scales; Günther says *H. sexcatus* has a series of shields. He also states that the hind limb extended only reached to the posterior margin of orbit; in the present species it reaches

[Nov.

considerably in front of the orbit. Günther gives twenty femoral pores; in the present there are twenty-four on each side.

In other respects, as to squamation, scutellation, etc., Günther's description applies to this species. See Proc. Zool. Soc. Lond. 1859. The allied *H. septemlineatus* A. Dum. differs in the less divided scales of the front, as well as in being seven-banded.

This Saurian is dedicated to my friend Robert Bridges, M.D., Professor of Chemistry in the Philadelphia College of Pharmacy, and an active member of the Academy of Natural Sciences.

The species is represented by one specimen in the Museum of the Academy.

OPHEOMORPHUS MINUS Cope, sp. nov.

This is the only species of the genus which has the black annuli on red ground, characteristic of *Erythrolamprus* and other genera of American *Coronellines*, *Elaps*, etc. Its general appearance is exactly that of *E. venustissimus* with single rings, or *Ophibolus micropholis* with confluent rings. It agrees entirely with other species of this genus in double anal, short tail, diacranterian dentition and lack of scale-pores, but is slightly abnormal in the rudimental condition of the loreal plate; it is on one side entirely wanting.

Superior labials seven, eye over third and fourth, fifth largely in contact with postoculars. First, the only one longer than high. Muzzle short, head slightly distinct. Internasals transverse; orbitals 1—2, the anterior not reaching frontal. Temporals 1—2. Scales in 15 series, broad as long. Frontal with straight sides convergent behind; its length greater than its breadth, and longer than common suture of occipitals, though shorter than greatest length of the latter. Tail 6.8 times in total length; i. e., 2 in. 3 l. out of 13 in. 6 l.

General color crimson, each scale with a brown spot near its tip. Ten black rings of 3 and 3.5 scales in width cross the body. They are sometimes divided, and the halves alternate; they are complete across the belly, but have a tendency to divide, especially the posterior. One pair of complete annuli on the tail, and four spots above near the tip. No black collar, chin uniform; head above and spot below eye black; plates on sides of muzzle and temples black-edged.

The long posterior maxillary tooth of this species presents a singular structure. Its section is triangular, two of the sides being shallow concave. The angle between these is the section of an acute posterior ridge of the tooth; the anterior face of the tooth is convex. The posterior sides being slightly concave to the tip, in some lights suggest the presence of the groove of *Erythrolamprus* and other genera, but both are similar, and neither is a true groove.

The habitat of this species is a mining district in the higher regions of Ecuador or New Grenada, but the exact locality I cannot fix. It was found with the following species: *Anolis fraseri* Gthr., *Rhabdosoma microrhynchum* Cope, *Holcosus bridgesii* Cope, *Opheomorphus minus* Cope, *Amphisbæna fuliginosa* L., *Masticophis pulchriceps* Cope, and *Elaps sævus* Cope.

Specimens in Mus. Academy from Edward Day, of the Assay Department of Columbia College, New York.

LIOPHIS FLAVITORQUES Cope, sp. nov.

This is a small and aberrant species of the genus. Its peculiarity consists in a projecting rostral plate, as in *Lygophis conirostris* Gthr., which is consequently developed on the upper aspect of the muzzle. The tail is also rather longer than in any other species, its length entering the total 3.2 times. In this it approaches *Dromicus*.

Internasal plates about as long as wide; prefrontals considerably wider than long. Frontal with superciliary borders each one-third the anterior suture, and about half the occipital; thus the plate is very wide, with a long produced posterior angle. Each nasal higher than long, narrower than the loreal; latter higher than long, straight above, angulate below. Preocular higher than long, 1868.]

two postoculars; temporals 1—2. Superior labials seven, all higher than long except the last, third and fourth bounding orbit. The eye small, pupil round. Inferior labials seven, the fourth as long as any three others, the first well developed behind symphyseal. Genials short, the posterior half the length of the anterior, and separated by a plate. Scales in seventeen series, rather broad, subequal. Gastrosteges 188; anal 1—1; urosteges 105. Total length 17.5 inches; of tail 5.5 inches.

Everywhere above dark brown, except a broad yellow half-collar which crosses the posterior half of the occipital shields and two rows of scales. Below dirty yellowish.

This serpent is from the Magdalena river, New Grenada. Brought by Schulte Buckow, of New York.

The physiognomy of the head of this species is somewhat like that of *Oxyrhopus*, though the characters are different.

LIOPHIS PERSIMILIS Cope, sp. nov.

This species is very much like the *Coniophanes fissidens* Gthr. in general appearance; it differs generically in its uniporous scales and entire posterior maxillary tooth. It also resembles *Rhadinæ obtusæ*, but differs also in dentition and pores. The form is more like the latter than the former, as the head is relatively small.

Scales in 17 rows. Frontal nearly as wide as superciliary suture; occipitals long, truncate behind; supranasals very small. Postnasal much larger than prenasal, loreal nearly square; preocular one, narrow, not approaching frontal. Two postoculars. Seven upper labials, eye over third and fourth; postoculars two; temporals 1—2—3. Inferior labials seven; post-genials longer than pre-genials. Gastrosteges 131 and 1—1. Urosteges 70.

Total length 11 in. 3 l.; of tail 3 in. 3 l. Above light brown, with a dark brown band on each side, from the neck to the end of the tail, which is dark bordered above on the lower edge of the fourth row of scales. Labial plates white edged above. Belly and tail below yellow, a black dot on the edge of each scutum and scutellum.

From Rio de Janeiro, Brazil; brought by the Thayer expedition. Mus. Compar. Zoology, No. 436.

CONOPHIS PULCHER Cope, sp. nov.

Scales in nineteen longitudinal rows. Loreal a little longer than high; orbitals 1—2, temporals 2—3. Muzzle rather projecting. Head little distinct. Superior labials, eight, higher than long except the last, fourth and fifth forming orbit below. Gastrosteges 73, anal 1—1; urosteges 67. Total length 29 in. 3 l., of tail 6 in. 3 l.; of gape 9.2 l.

Six dark longitudinal bands on a light ground. First a black band along the middle of the first row; second a dark brown black edged on the third and half the second and fourth; third a similar broadly black margined, on the eighth and half the seventh and ninth, separated from its fellow on the other side by a median stripe of only one scale in width which is black edged. This median band disappears on the nape, leaving a broad band to the end of the muzzle, extending over the occipitals and superciliaries. The lateral band extends in like manner to the end of the muzzle including the upper edges of the labials. Throat clouded with blackish below. Belly yellow with a few specks on each end of the gastrosteges. Upper labials broadly brown edged below. The bands extend to the end of the tail.

From near Peten, Vera Paz. Henry Hague; Museum Smithsonian.

This handsome species is near the *C. vittatus* Peters, but differs in many points of coloration, and in having one more labial shield above and below. From *C. lineatus* D. and B., it differs also very much in coloration.

HELICOPS FUMIGATUS Cope, sp. nov.

Scales in nineteen rows, keeled anteriorly and posteriorly, lower rows smooth.

[Nov.

Two pairs genaeals; occipitals short and broad. Dark brown, with numerous lighter or dark gray cross bands, which are black edged, and extend to the first row of scales, and are sometimes interrupted on the vertebral line. Belly with a broad brownish gray band from throat to vent, the ends of the gastrosteges yellow, forming two bands; a median longitudinal brown line on the tail.

Tail 3·3 times in length. The plates of the head and other peculiarities are quite like those of *H. angulatus*.

From Surinam, Mus. Academy Natural Sciences. Discovered by Chas. Hering, M.D.

HELICOPS CYCLOPS Cope, sp. nov.

Scales in nineteen rows, strongly keeled everywhere, including the first row. Two pairs genaeals; occipitals short and wide, long as frontal.

Head exceedingly short, mouth wide as the length of the rounded lip margin. Superior labials eight, fourth scarcely entering orbit by its upper corner (by its whole extremity in *H. angulatus*), the fifth, sixth and seventh narrow and high. Prefrontals broad as long (much broader than long in *H. angulatus*). Orbitals 1—2, nearly meeting below orbit. Temporals 2 | 1 | 3 (1 | 1 | 3 in *H. angulatus*). Loreal plate wide as high, (higher than wide in *H. angulatus*).

Tail ·33 total length, slender (less than ·25, *H. angulatus*). Gastrosteges 124, anal 1—1; urosteges 89.

Light yellowish brown, with twenty-six transverse deep brown rhombs across the back which terminate at the second row of scales, being separated from the back ventral cross-bar, which is opposite each, by a longitudinal yellow band. This band is not distinct between the spots. Belly strong yellow with jet black cross bars, which are on more than two gastrosteges. Tail black, spotted below. A brown cross-band between the eyes.

Length 27·5 inches. From Bahia, Brazil. Mus. Academy, from Dr. Otho Wucherer.

This species is at first sight much like the *H. angulatus*, but differs variously as above. In coloration the spots in the latter are always continued into the ventral cross-bars, and not interrupted as in *A. cyclops*.

The species of the genus are as follows: *H. carinicauda* Nieuw. *H. modestus* Gthr. *H. lepieurii* Dum. Bibr. *H. chrysostictus* Cope. *H. infrataeniatus* Jan. *H. fumigatus* Cope. *H. cyclops* Cope. *H. angulatus* Linn. *H. polylepis* Gthr. The following species have been erroneously referred to this genus: *H. wagleri* Jan. is *Tetranorhinus variabilis* Dum. Bibr. *H. agassizi* Jan. is *T. nigroluteus* Cope. *H. schistosus* Jan. is *Atretium schistosus* Daudin, and *H. mortuarius* Jan. is *Tropidonotus mortuarius* (Boie) Schlegel (*Tropidonotus ferox* Günther).

THRASOPS PRÆSTANS Cope.

The largest species of the genus, exceeding considerably the *T. flavigularis* of Hallowell. The length of one sp. is 6 ft. 3 in., of which the tail is 2 ft. 3½ in., while the body of another measures 4 ft. 6 in., giving a total of seven ft. 1 in. Length head to end of quadratum 1 in. 10 l., width between superciliary margins 8 lines, diameter orbit 4 l.; from orbit to end of muzzle 6 lines.

The head is very distinct, and the muzzle rather short for the genus; the eyes are very large. Rostral plate small, postnasal lower than prenasal; place of the loreal entirely occupied by the prefrontals. Orbitals 1—2, the anterior not quite reaching the frontal. Frontal one-sixth longer than wide in front, with concave sides and short posterior angle. Occipitals broad, short, divaricate behind; temporals 1—2. Superior labials nine, fifth and sixth in orbit, last two longer than high. Inferior labials 11, the anterior very wide; postgenaeals longer than pregenaeals.

Scales in fifteen rows for a part of the length, in eleven, on the posterior 1868.]

half of the body. They are without pores on the side, but are uniporous on most of the rows. All the rows except the inferior, are carinate. On the middle and posterior part of the length, that of the vertebral becomes obsolete, and then vanishes, while those of the two on each side, especially the superior, become very strong. Tail entirely smooth. Gastrosteges 180. Anal divided; urosteges 176; the first are strongly turned up at the sides, and not angulate.

The teeth increase in length gradually to the posterior end of the maxillary bone, where the last is abruptly the largest; they are strong, and eleven in number.

Color everywhere bluish green without metallic reflection, the keels of all the scales black.

This beautiful species was sent to the Smithsonian Institution by its correspondent Henry Hague, near Peten, Guatemala,

LEPTODIRA PACIFICA.

Scales in nineteen series, biporous, all nearly equal. Body cylindric, neck little compressed; head short, broad. Oculars 2—2, loreal higher than long. Superior labials seven; eye over third and fourth. Temporals 1—2. Frontal longer than broad, with straight parallel borders; occipital elongate, truncate behind. Internasals long as wide, one-third prefrontals. The superior pre- and postoculars are both much larger than the inferiors. Gastrosteges 164, anal 1—1, urosteges 61 pairs. Length of head and body 7 in. 3 l., of tail 2 in.

Color above bright rose-brown, with four series of blackish-brown, very small spots, of which the median pair forms usually a short cross-bar by their union; in this case they extend over five series of scales. The lateral spots are on the fifth row, and cover half a scale. A broad black bar across the nape; a short brown line behind each eye, and a number of dots on the crown. Below uniform cream color.

The above description is derived from a young animal. It was given to the Smithsonian Institution by its correspondent, G. Bischoff, and sent to me for examination. In its characters it approaches the species of *Hypsigena* (*Pseudodipias* Peters,) but has a grooved maxillary tooth and double scale-pores. It has different labials, scales and coloration, from the *L. annulata*.

LEPTODIRA PERSONATA Cope, sp. nov.

Body slightly compressed, neck contracted, head elongate, narrowed in front of the orbits. Scales equal, biporous, in twenty-three rows. Internasals broader than long, frontal elongate, with parallel sides, superciliaries narrowed, occipitals narrowed, elongate, rounded behind. Temporals 1—2; oculars 1—2, anterior barely reaching frontal; loreal long as high. Superior labials eight, fourth and fifth in orbit. Geniials equal. Gastrosteges 173, anal 1 | 1 |, urosteges ? (tail mutilated). Length head and body, six inches.

General color cream, with broad black cross-bands on the dorsal region. These extend from the gastrosteges anteriorly, posteriorly from the first series of scales. There are twenty-three between nape and vent, which are wider than the intervals. Top of head except upper labials entirely black; a broad yellowish collar. Below immaculate.

The Smithsonian collections have received this species from Mazatlan, Western Mexico, from G. Bischoff. It was sent with the *Leptodira pacifica*, *Agalychnis dacnicolor* Cope, and *Holbrookia bischoffi* Cope and other species.

PHIMOTHYRA DECURTATA Cope.

This species resembles considerably the species of *Lytorhynchus* Peters, which genus in Africa represents the American *Phimothyra*. They differ only in dentition, the former being diacranterian, the latter rather coryphodont.

This species is distinguished by many features. The head is shortened and

[Nov.

somewhat arched, the rostral plate very broad and free, entirely separating the internasals. There is a complete annulus of scales round the eye. The tail is relatively shorter than in the known species.

Ground color light grey; a series of elongate parallelogrammic brown blotches occupies the dorsal region, from the nape to the end of the tail. Labials and under surfaces unspotted.

Length about fourteen inches. This serpent is remarkably different from the three already known representatives of the genus. In these the orbit rests on the labials, and the color is in bands.

Presented to the Mus. Acad. Nat. Sci. by Wm. M. Gabb, who discovered it in the upper part of Lower California.

PELTAPHRYNE LEMUR Cope, sp. nov.

This is a toad of singular aspect, owing to the extraordinary development of the bony crests of the cranium and the large size of its eyes.

The muzzle is short and very much flattened, projecting much beyond the mouth. The upper lip forms indeed a strongly projecting bony rim all round the mouth. Loreal region very concave, canthus concave and very close together. The superciliary crests are extraordinarily elevated, having an arched outline, and descending steeply to the loreal region. It is angulate posteriorly, joining the almost equally developed supratympanic ridge. The crown of the head is thus a deep basin, widened above the tympana, and obstructed by a cross-elevation in front. Strong ridges behind and before the orbit; nostrils vertical, a short bony longitudinal ridge below them. According to the characters of the genus there is no derm on the head. Tympanum vertically oval. Parotoids broad oval, directed obliquely downwards, covered like the remainder of the upper surfaces of the body and limbs, with numerous closely placed sub-round tubercles, with rugose surfaces. Feet rather short, with small tubercles, and only one remarkably weak metatarsal tubercle, the inner. A strong corneous ridge on the inner margin of the tarsus. The heel reaches the middle of the parotoid. The toes are about half-webbed, and have a strong dermal margin. Two strong carpal tubercles. Under surfaces studded with small tubercles, with acute points. Tongue obovate, largely free.

| | In. | Lin. |
|------------------------------------|-----|------|
| Length head and body..... | 4 | 5.5 |
| “ to axilla..... | | 2 |
| “ “ posterior margin tympanum..... | | 15 |
| “ “ anterior margin orbit..... | | 6 |
| “ of fore limb..... | 2 | 5.5 |
| “ “ hind limb..... | 4 | 3.5 |
| “ “ foot..... | 2 | 4 |
| Width of head behind..... | | 17.5 |
| “ interorbital space.. | | 8.5 |
| “ top of muzzle..... | | 1.3 |

The color above is a blackish-brown, the top of the head yellow shaded; two longitudinal brown spots on the frontal region. A light vertebral line disappears on the back and reappears on the coccyx, and another light line passes round the inside of the parotoids and diverges on the scapular region. Limbs yellowish cross-banded, below dirty white, below the vent blackish.

This curious animal was found by George Latimer, the correspondent of the Smithsonian Institution in Porto Rico, W. I. We are indebted to the same zoologist for the following species:

PELTAPHRYNE LEMUR Cope.

CYSTIGNATHUS ALBILABRIS Gthr. var.

HEMIDACTYLUS MABUYA Cuv.

MABUYA FULGIDA Cope.

DIPLOGLOSSUS DEGENER Cope.

1868.]

ANOLIS VELIFER Cuvier. The female of this species would fall in the "genus" *Eupristis* Fitz.=*Dactyloa* Gray.

TYPHLOPS sp.

CHILABOTERUS INORNATUS Dum. Bibr. Only found elsewhere in Jamaica.

ALBOPHIS SANCTICRUCIS Cope (= *A. melanichnus* Cope).

OTASPIS EMPUSA Cope. *Peltaphryne empusa* Cope, Proc. Acad. Nat. Sciences, Philad. 1862, p. 344.

This species does not belong to *Peltaphryne*, but to a genus which I now name. It differs from the former in the existence of an additional superficial arch of the skull, which passes from the mastoid region behind the auricular meatus, thus enclosing the latter, and causing it to be a mere foramen perforating a shield of bone. This is the only genus of living *Batrachia* in which the external ear is thus completed behind. It is a tendency of *Peltaphryne* carried to its highest extreme.

Cuba; found by Prof. Poey.

LYSTRIS BRACHYOPS Cope, sp. et gen. nov. *Cystignathidarum*.

Tribe *Pleurodemæ*, same group as *Pleurodema*, differing only from that genus in the presence of two strong shovel-like metatarsals, as in the genus *Systema*.

Its characters are, therefore: cranium with a fronto-parietal fontanelle; xiphisternum an osseous style, with furcate cartilage disc. Vomerine and maxillary teeth well developed; a large inguinal gland; two metatarsal shovels.

It differs from *Gomphobates* in its fontanelle and vomerine teeth, but is intermediate between this genus and *Pleurodema*, showing that the tribes *Pleurodemæ* and *Cystignathi* should be closely approximated. It differs only, so far as we know the characters, from *Eupemphix* Steind, in the presence of a well-developed dentition in adults as well as young. The other characters of *Eupemphix* are not yet known, or whether it is nearer this genus or *Gomphobates*. Steindachner's second species of *Eupemphix* I would refer here, and call it *Lystris fuscomaculatus*. Name of the genus from *Augeton*, a trowel.

Char. specificus.—Vomerine teeth in two short oblique series directed forwards between the nares, about as far from the latter as from each other. Tongue a flat oval, one-third free. Head broad, occiput slightly swollen, canthus rostralis straight, obtuse, convergent; loreal region vertical plane. Diameter of bony orbit equal length of muzzle; the latter contracted, elevated, rounded in profile; nostrils nearer end than orbit. Membrum tympani one-third orbit. Ostia large as nares. Males only with a subgular sac, with large lateral slits. Limbs short, stout; the heel barely reaching the tympanum. Toes quite short, free, without dermal margins. No tarsal median tubercle or fold. Inguinal gland large subovate. Skin smooth above and below; a few ill-defined warts on the back. Lengths of fingers 3—2—1—4.

| | In. | Lin. |
|---|-----|------|
| Length head and body..... | 1 | 8.5 |
| " muzzle to posterior edge tympanum. | | 7 |
| " hind limb..... | 2 | 2 |
| " foot..... | | 13.5 |
| " tarsus..... | | 4.8 |
| Width head just behind tympanum..... | | 6.4 |

Color above dark brown, with several darker brown broad irregular bands, which cross the back in three places or are broken into spots, and are sometimes confluent longitudinally. Sides with dark brown lines and specks. Lip with two vertical brown bands on each side. Inguinal glands black, white-speckled. Limbs brown, deeper banded; sole from heel dark brown. Below yellow, gular region brown.

Magdalena River, New Grenada. Schulte Buckow, collector.

[Nov.

SPHELRPES LINEOLUS Cope, Proc. Acad. Nat. Sci. Philad. 1865, 196. *Ophiobatrachus vermicularis* Gray, Ann. Mag. N. Hist. 1868, 297.

This species varies somewhat in the relative length of the tail. One of the specimens from Cordova, Vera Cruz, measures as follows: head and body 17·3 lines; tail 2 in. 10·4 lines.

In the collections of the Smithsonian Institution.

GROTRITON CARBONARIUS Cope.

A uniformly black variety of this species occurs in the high lands of Guatemala, and another with two dorso-lateral ochre bands is found in Yucatan. Mus. Smithsonian.

Dec. 1st.

The President, Dr. HAYS, in the Chair.

Thirty-five members present.

The following papers were presented for publication:

"Notice of some remains of extinct Insectivora from Dakota."

By Dr. J. Leidy.

"Observations on Reptiles of the Old World. Art. II." By Edw. D. Cope.

"Notes on some points in the structure and habits of the Palæozoic Crinoidea." By F. B. Meek and A. H. Worthen.

DR. LEIDY exhibited some specimens of Mica recently received from Westport, Canada, remarkable for the beauty and distinctness of its asterism, produced by minute acicular crystals profusely scattered between the laminæ. The star exhibited twelve equidistant rays, exceeding in strength any previously seen by him in varieties of the mineral.

PROF. COPE made some observations on some extinct reptiles of interest. One of these, represented by a single sacro-caudal vertebra from Swedesboro', N. J., indicated a second species of *Elasmosaurus*. It was of equal size with the corresponding one of the Kansas specimens, but differed in the square and uncontracted form of the centrum, and greater stoutness of the diapophyses. He called it *E. ORIENTALIS*.

Another reptile was represented by a vertebra, tooth, and portion of mandible. It was a gavial-like crocodile, which if of proportions similar to those of the Gangetic species, would indicate an animal of thirty feet in length. It belonged to the genus *THECACHAMPSA* Cope, and was allied to the *T. ANTIQUA* (*Crocodylus* Leidy), but differed in the more compressed knife-like tooth crowns. Miocene of Maryland.

He also exhibited bones and teeth of a large Rodent from the cave deposits of Anguilla, one of the Virgin West India Islands. The characters observed were those of the genus *Chinchilla*, but the roots of the teeth were contracted and not so open as in many Rodents, as though having a more limited period of growth, or perhaps like deciduous teeth, which are much reduced in number in most Rodents. The species was nearly as large as the *Castoroides ohioensis* of North America, but had relatively smaller incisor teeth. The body was probably as large as that of the Virginia deer, and the limb bones as stout, as seen in portions of femora and other pieces preserved. He called the animal *AMBLYRHIZA INUNDATA*, and thought that its discovery on so small an island, with others of like character, indicated that the Carribean continent had not been submerged prior to the close of the Post-pliocene, and that its connection was with other Antilles, while a wide strait separated it from the then comparatively remote shores of North America.

MR. MEEHAN stated that it is a fact well-known to most of us, that the *Wisteria sinensis*, as we find it cultivated, rarely produces fruit. The large seed vessels I now present are from a plant I have which bears abundantly. Why it does so I think may prove of interest to the members.

A few years ago Darron discovered motion in tendrils. Subsequently, in a paper published in our Proceedings, I showed that this motion required nutrition for its force, which was so much abstracted from growth. I explained by this what had hitherto been a mystery, why grapes grew more freely and healthy when running over trees, than when exhausting their vigor in fruitless motion to find something to cling to. I referred to many plants on which I had experimented, amongst others *Wisteria sinensis*; a plant was trained a few feet high and then left to support itself. It took all its food to fight gravitation. Since then it has continued to grow as a bush or small round-headed tree, unless a branch happens to extend to the ground, or a neighboring bush, when such branch will push forth with its old time vigor. In proportion as this plant has lost the power of growth, it assumes a reproductive power. This year from my little *Wisteria tree* I have gathered a half-peck of seed pods.

That weakened vigor is favorable to reproduction is well known to the horticulturist. Hence the operations of root pruning, transplanting, summer pruning, and ringing the bark. The novelty of this *Wisteria* incident is that an excessive draft on the force necessary to overcome gravitation in the ascending plant is also an enfeebling cause.

The facts I have given have a three-fold interest. To the structural botanist, enabling him to get specimens of fruit for examination hitherto hard to be obtained; to the horticulturist, furnishing him with the means of freely propagating a plant hitherto rather difficult to increase, and to the natural philosopher, furnishing an additional illustration of what I have hitherto advanced, *that growth in a great measure is a struggle with gravitation, requiring great efforts by the nutritive powers of the plant to sustain it.*

Dec. 8th.

The President, DR. HAYS, in the Chair.

Thirty-one members present.

Dec. 15th.

The President, DR. HAYS, in the Chair.

Thirty-four members present.

The following paper was presented for publication:

"On the seed vessels of *Forsythia*." By THOS. MEEHAN.

Mr. Cope offered the following resolution which was adopted:

Resolved, That the Academy of Natural Sciences present their thanks to Theophilus H. Turner, M. D., U. S. A., for his very valuable gift of the skeleton of the great extinct reptile, the *Elasmosaurus platyrurus*, from the neighborhood of Fort Wallace, Kansas.

Dec. 22d.

The President, DR. HAYS, in the Chair.

Thirty-four members present.

[Dec.

The following papers were presented for publication :

"Remarks on some new types of Carboniferous Crinoidea, with descriptions of new forms." By F. B. Meek and A. H. Worthen.

"Descriptions of seven new species of American Birds from various localities, with a note on *Zonotrichia melanotis*." By Geo. N. Lawrence.

"Analytical table of the species of *Baridius* inhabiting the United States." By John L. LeConte, M. D.

"The Gyrinidæ of America, north of Mexico." By John L. LeConte, M. D.

"Notes on the species of *Agonoderus*, *Bradycellus* and *Stenolophus* inhabiting America, north of Mexico." By John L. LeConte.

Dr. Leidy exhibited some photographs of fossil bones, received from Mr. W. E. Webb, Sec. of the National Land Co., at Topeka, Kansas. They represent vertebræ, and fragments of jaws with teeth, of a skeleton of *Mosasaurus*, reported by Mr. Webb to be about 70 feet in length, recently discovered on the great plains of Kansas, near Fort Wallace.

Dec. 29th.

MR. JOS. JEANES in the Chair.

Fifty-three members present.

The following gentlemen were elected members :

Albert Peale, Franklin Platt, Jr., Edw. A. Spooner, M. D.

The following were elected correspondents :

Geo. Neville, of Calcutta, E. I. ; Rev. Dr. Joseph F. Berg, of New Brunswick, N. J.

The Committee to which was referred a paper, entitled "*Phosphorus and Fatty Degeneration*," reported in favor of its publication in the American Journal of Medical Science.

On favorable report of Committees, the following papers were ordered to be published :

Notice of some remains of extinct *INSECTIVORA* from Dakota.

BY JOSEPH LEIDY.

Dr. Hayden, in his trip to the Mauvaises Terres of White River, Dakota, in the summer of 1866, discovered the remains of two genera of insectivorous mammals, which appear to be peculiar, but related to the hedge-hogs.

LEPTICTIS HAYDENI. This name, appropriate to one of the animals, is founded upon a nearly entire skull devoid of the lower jaw. The specimen belonged to a mature animal, as indicated by the complete and worn condition of the teeth ; but the skull retains most of its sutures as distinctly as is usual in the *Opossums*. It is less in size than that of the Mink, and its shape is more canine than musteline. It bears some resemblance in form to that of the insectivorous genus *Glisorex*, or to that of the viverrine genus *Eupleres*.

The cranium is remarkable for the possession of a pair of prominent ridges defining the upper part of the temporal fossæ, as in the fossil cranium represented by De Blainville (*Osteographie*, *Mustela*, pl. xiv) under the name of *Mustela plesictis* from Auvergne, and by Gervais (*Pal. Fran.* pl. 28, fig. 2) 1868.]

under the name of *Mustela angustifrons*. Similar ridges, relatively less well-developed, exist in the Gray Fox.

The orbits are as little distinct from the temporal fossæ as in the Skunk or the European Hedge-hog.

The cranium back of the orbital spaces is conoidal and wider than high. It is narrowest just back of the postorbital eminences; relatively not so much constricted as in the Mink or Fox, though more than in the Skunk or European Hedge-hog.

The face is long, and tapers evenly to the end of the snout.

The palate is long, narrow and moderately arched, and exhibits no large perforations as in the Opossums.

The fossil retains most of the teeth, the number of which consists of seven molars, a canine and two incisors.

Of the molars the posterior four have broad trilateral crowns, with a number of points or tubercles, as in the Opossums and Hedge-hogs, or the back two in the Dog. The anterior three molars have simple, compressed conical crowns. The canine is comparatively small. Whether the animal possessed more than two incisors on each side is uncertain.

Measurements from the specimen are as follows:

| | |
|--|-----------|
| Estimated length of skull from occipital foramen to fore part of incisive alveoli..... | 29 lines. |
| Length of cranium frominion to fronto-nasal suture..... | 18½ " |
| Breadth at zygomata..... | 17½ " |
| Length of palate..... | 15½ " |
| Length of molar series..... | 11 " |

ICTOPS DAKOTENSIS. This name is founded on a small fragment of a skull which was obtained with the preceding. At first the specimen was supposed to belong to the same animal as the former. It clearly indicates a skull of nearly the same size and shape as that of *Leptictis*.

The fragment consists of a portion of the face, containing the remains of most of the molar teeth. The face appears to have had nearly the same form and construction as in *Leptictis*, and the forehead exhibits traces of the two peculiar ridges defining the upper part of the temporal fossæ in the latter.

The remains of the molars consist of the posterior six. The second premolar appears to have been a two-fanged, conical crowned tooth, as in *Leptictis*. The third premolar has a trihedral crown, inserted by three fangs, whereas in *Leptictis*, as in the preceding tooth, it has a simple conical, crown with a pair of fangs.

The crown of the third premolar of *Ictops* is composed of three principal lobes, two external and the third internal. The four back molars have the same relative position and size as regards one another as in *Leptictis*, but they do not project abruptly beyond the premolars externally as in this. Their crowns, so far as can be ascertained, appear to have had the same construction as in the third premolar.

The space occupied by the back six molars in *Ictops* is ten lines, being a little more than in *Leptictis*.

Observations on REPTILES of the Old World. Art. II.

BY E. D. COPE.

CHAMELEO BASILISCUS Cope, sp. nov.

This species pertains to group *a.* of Gray's arrangement of the species of this genus (Proc. Zool. Soc. Lond., 1864), that is, is nearest allied to *C. verrucosus* Gray, and *C. calyptratus* A. Dum. It has therefore a high longitudinal crest on the supraoccipital region, and the supraoccipito-mastoid crest is not furnished with any dermal margin of flap behind, but is the margin of a truncate face which is minutely scaled. No dorsal or ven-

[Dec.

tral crests except a few conic scales above the scapulæ. Gular region with a weak crest.

The occipital elevation is vertical behind, the lateral ribs but little oblique, and joining the superciliary crest at a little more than a right angle. Median crest very convex, nearly vertical below. Superciliary crests continuous, not arched, descending straight and obliquely to the muzzle. None of the crests denticulated. Scales everywhere granular, equal. Nine rows of subequal scales between lateral and median occipital crests; six between canthus on the muzzle. Tail little compressed.

Color gray and leaden, with yellow shades. Three blackish radii back of orbit. A yellow band from chin to vent.

Total length 12 in. Muzzle to vent 5 in. 4.5 lines. Muzzle to orbit 6 lin. Length of hind limb 2 in. 6 l.

This species was obtained at Korusko, Nubia, by Prof. H. A. Ward, and placed in the Museum Peabody Acad., Salem, Mass. No. 489.

This Chamæleon resembles the *C. vulgaris*, and is intermediate between it and the *C. verrucosus*.

It may be observed that the *Chamæleo burchellii* of Hallowell cannot be regarded as more than a variety of *C. granulosus* of the same author, and that *C. capellii* Du Bocage appears to be the same so far as the description goes.

PANASPIS æNEUS Cope, sp. et gen. nov. Scincidarum.

Char. genericus. Allied to *Morethia* Gray, differing only in the distinctness of the fronto-parietals from each other and from the interparietal, all three being united in the latter genus. No eyelid; a supranasal; rostral not prominent. Limbs short, toes weak, 5—5. Scales smooth.

Character specificus. Scales large, in twenty-four longitudinal series. Two loreals, one behind the other; two preoculars, one above the other. Fronto-nasals broad as long, separated by frontal, which reaches the internasal. Frontal acute behind, smaller than each frontoparietal, but a little larger than the interparietal. Lateral parietals meeting behind the last named, and followed by two transverse scales each. Superciliaries and suparorbitals four each. Two large marginal anal scales.

General proportions slender, the head remarkably so, the tail proportionately stout. The appressed extremities do not meet by the length of the longest finger. Toes 1 and 5 equal, 3 and 4 nearly so, elongate. Inner finger very small. Superior labials eight, fifth immediately below orbit, last three scale-like, large; anterior quadrate. Tail with cross scuta beneath.

Total length 3 in. 5 lin. To vent 15 l.; to axilla 6 lin.; to ear 3 l.; to orbit 1.2 l. Length fore limb 3 lin.; hind limb 4.5 l.

Color. Golden olive above, darker behind, with a narrow golden line on each side from the temple to the base of the tail. Sides above darker, below lighter, pale spotted. A whitish line from below eye to near axilla. Limbs and tail above brown, with small round white spots; below greenish white; tail pale brownish beneath.

Habitat. Probably Swan River, Australia; possibly from South-Western Africa.

Name, from its complete cephalic scutellation, all the plates usual among lizards being present.

EUMECES PERDICOLOR Cope, sp. nov.

Twenty-eight series of broad scales on the body, all entirely smooth. Body fusiform, the limbs very short, with short but unequal toes. Tail cylindric.

Rostral plate low, broad, prominent, but not acute. Infranasals as long as broad, largely in contact. Internasal much broader than long; fronto-nasals small, widely separated. Frontal long, rounded behind; fronto-parietals well in contact, large, rounded behind; inter-parietal smaller than the latter, parietals well in contact behind it. Dorsal scales equal, a little

1868.]

smaller than ventrals. Ear large, membrane deeply placed; no marginal tubercles or scales. Nasals not divided; preloreal higher than postloreal; two preoculars. Superior labials seven, fourth long, below orbit, no sub-orbital plate. A transverse symphyseal, and broad transverse mental. Inferior labials seven. Five supraorbital plates. Scales in front of vent equal.

| | In. | Lin. |
|----------------------------|-----|------|
| End of muzzle to vent..... | 3 | 3 |
| “ “ to axilla..... | | 13 |
| “ “ to orbit..... | | 2.7 |
| Length of fore limb..... | | 5.9 |
| “ hind “ | | 8.2 |

Color above brown, uniform on the back, each scale with a large white spot near the centre, on head, body and tail. Lower labial and gular scales white, with a brown spot, upper labials brown, with a white spot; white below, all the scales brown edged; in a younger specimen laterally, only in an older all round.

This well marked species is a native of Zanzibar. Mus. Academy and Peabody Acad. No. 499. From H. F. Shepard. I have referred this species to the genus nearly as restricted by Dr. Gray, including with it *Plistodon* and *Otosaurus* of his catalogue, as forming together a definable genus.

SEPSINA Bocage.

SEPSINA GRAMMICA Cope.

Scales in 22 rows. Limbs small, the anterior one-third the length of the posterior; toes 3—3. Nostril between four plates; frontonasals and internasals united into a shield which is broader than long. Supraorbitals and superciliaries four each on each side. Frontal concave behind, and wide as long; interparietal nearly as wide, large; two pairs of parietals, the interior meeting behind; two pairs transverse plates behind them. Nasal, loreal and preorbital present; rostral flattened, not acute. Eye over fourth labial. Anal and abdominal plates equal. Ear minute.

Length to ear 8" (French); to axilla 15" 75". Axilla to groin 5' 5". Fore limb 2", posterior limb 7". Tail elongate, mutilated.

Below brownish yellow, above fawn brown; four rows of scales on each side, with a dark line in the centre, forming interrupted streaks. Hind limb streaked above in the same way. Tail more distinct, spotted, on the under surface faintly; above dark banded.

This species differs from the type described by Bocage, (*Journal de Sciences, Mathematiques, Physicas e Naturæ* Lisbon, 1866, 26), in its coloration, in having two rows of scales less; in having fore limbs very much smaller, less than one-third the posterior, (they are more than one-half the same in the *S. angolensis* Boc.). In the latter the internasal and frontal are much more elongate, and the interparietal very much smaller, according to the description and figure of the above author.

Museum of the Essex Institute. No. 512. Discovered by Edmunds Lovett, on the South-West Coast of Africa.

OEDURA VERRILLI Cope.

The femoral pores in a series arched angularly forwards and not extending on the femora. The plates of the under surfaces of the toes are besides the terminal discs, one pair only, as large as the terminal and at the end of the antepenultimate phalange. Labials regular, 8—7 to below pupil; two rows infralabials across chin. Rostral undivided. Gular scales granular; thoracic and ventral flat, larger than the flat dorsals. Muzzle scales tubercular. A tubercle on each side vent. Head as broad as from end of muzzle to half way between orbit and ear. Color very pale above, with six very deep brown cross bands from nape to sacrum, which are more or less connected on the sides. A brown band through orbit, and one behind, crossing the occiput.

[Dec.

Muzzle to ear 12''; to axilla 20''·5. Axilla to groin 25''; tail lost. Fore limb 13''; hind limb 18''.

With *Diplodactylus marmoratus* Gray, from Australia. No. 724. Mus. Comparative Zoology, Cambridge, Mass.

Dedicated to my friend Addison E. Verrill, Professor of Zoology in Yale College, Connecticut.

PEROPUS Wieg.

Three species of this genus before me differ from those described, and may be compared as follows:

I. The tail much depressed, and with a series of broad shields below.

Margin of tail minutely serrate; two internasal plates; mental plates abruptly different from gular scales, in one cross row of six, and smaller ones at the angles in front of a straight cross-line. Pale brown with close reddish speckles..... *P. packardii*.

II. The tail broad, depressed, slender, with small scales below.

A few internasals, two longitudinal rows, hexoganal mentals; gray with scattered brown spots..... *P. mutilatus*.

III. Tail thickened, depressed, cylindric, without serration; scaled below.

Four cross-rows ovate mental plates, the posterior smaller; three internasals; pink-grey, with brown later shade, with pairs of black dots on each side the middle line, which form stræ on the scapular and crural regions. Tail subcylindric..... *P. roseus*.

Two cross-rows ovate mentals, those behind graduating through several rows to the gulars; four internasals; tail swollen; light gray with a brown band on each side..... *P. pusillus*.

PEROPUS PACKARDII Cope.

This is a stout species. Günther's description of *Peripia peronii* Gray applies well to this, but in our animal the toes are all strongly palmate at the base.

Upper labials 9—7 to under the eye, lower seven; symphyseal large, triangular. Gular scales very minute, ventals larger than laterals, and laterals than dorsals. A thick femoral fold behind. Pores in a long line, from 35 to 40.

Light reddish brown, with small bay specks all over the upper surface. Several small round bay margined spots on the occipital and temporal region.

Head and body to vent 42''; muzzle to ear 11''·5; width at ear 8''·7, of tail 6''. Length of hind limb 14''·7.

Penang, Malacca. No. 476. Mus. Peabody Academy, Cambridge, Mass.

PEROPUS ROSEUS Cope.

This species is remarkable for its nearly cylindric tail. I find no femoral pores in two individuals, but a rather large series of scales abruptly divides the granular from the scaled portion of the femur, in their position. Upper labials eight to below orbit. No posterior femoral fold. Dorsal scales extremely minute. General form more slender than in the last species.

A black spot on each scapular, and one above each axillary region; one on the iliac, and a line above each ischiadic region; a row of black dots on the vertebral line of the tail. A brown band from end of muzzle to ear, then a black line to axilla.

Total length 77''; to vent 40''; to ear 10''; width at ear 4''·7.

No. 735. Mus. Comparative Zoology.

PEROPUS PUSILLUS Cope.

This little reptile differs from the last in the three structural and fourth coloration characters, beyond which it is difficult to observe further peculiarity. There are nine superior labials to below the pupil; there is no 1868.]

femoral fold, nor are there femoral pores. Color light brown, with a much paler dorsal shade; a brown band through orbit to axilla, and band across muzzle. Tail with a series of pale rounded spots on the median line above.

Total length 59''; to vent 35''; to ear 9''; hind limb 12''-5.

No. 407. Mus. Peabody Acad. S. W. Australia.

HEMIDACTYLUS Cuv.

HEMIDACTYLUS LONGICEPS Cope.

This species is like the *H. coctæi* D. B. in its very sparse tuberculation, for this appears in a single line of obtuse distant warts, on each side the lumbar region only. The thumb has a claw, however, and the tail is surrounded by rings of prominent tubercles. It has fewer tubercles than the *H. frenatus*, and differs further in having a long flat slender muzzle. The width of the head behind the orbits does not measure from the end of the muzzle to the posterior margin of the orbit, while in the *H. frenatus* it reaches the rictus of the mouth. Labials 10-9; mental projecting behind; postmentals two pair, the outer considerably smaller, the inner largely in contact. Femoral and preanal pores in one series.

Light reddish-brown, with a pale dark brown bordered ochraceous band from the end of the muzzle to the groin. Dorsal region brown-shaded; below white.

Length to vent 47''; to axilla 24''; to ear 13''.

Manilla; from Capt. J. W. Chever. Mus. Peabody Academy, Salem, Mass. No. 478.

HEMIDACTYLUS HEXASPIS Cope.

Tubercles flat, round, sparse, in a row on each side the median vertebral line, and three rows on each side, at a distance from the former. Caudal tubercles in three rows on each side. Labials 11-8, symphyseal produced behind; postmentals abruptly larger, three on each side, the median pair in contact half their length, the outer diminishing regularly. Femoral and preanal pores continuous in the male, both wanting in female. Three internasals; no tubercles on head or nape. Abdominal scales ovate, rather large.

Plumbeous above, with numerous pale blotches; a pale band from end of muzzle to groin, margined with leaden above and below, in the female with blackish; top of muzzle dark shaded above.

Length to vent 57''; to axilla 25''; to ear 13''.

Two specimens from Madagascar. No. 494, Mus. Peabody Academy.

This species is also related to the *H. frenatus*, but differs in the arrangement of the dorsal tubercles, and in the chin shields.

I may note here that the *Liurus capensis* (*Hemidactylus capensis* Smith, Zool. S. Afr.) occurs in the copal of Zanzibar. A specimen over two inches long, enclosed in a block of this substance, is in my possession. Its skeleton and viscera have been dissolved, and form a thick fluid easily visible on moving the specimen. The specimen has been included some time before the solidification of the gum, as the gases evolved during decomposition have raised large bladders in two places in the specimen. Another Gecko, probably a *Hemidactylus*, also occurs in the copal.

PENTADACTYLUS BRUNNEUS Cope.

Nostrils surrounded by four small shields and the first labial, the rostral being excluded. The anterior of the scales separated from its fellow by a polygonal scale, which is not included in a notch of the rostral. Rostral fissured above. Superior labials eleven, last two minute; two or three of them longer than high. Distinguishable inferior labials nine; two first much deeper than long. Infralabials not marked, forming some four or five rows of small ovate scales. Scaling of the body coarse. No superciliary spine; no preanal pores. Free joints of the toes, especially of the thumbs, thick.

[Dec.

Tail with whorls of flat hexagonal scales, abruptly separated from those of the sacrum above.

Color above brown, with seven irregular undulate, transverse bars of a very deep brown, between rump and nape. Below pale.

| | In. | Lin. |
|------------------------------------|-----|------|
| Total length..... | 5 | 7.5 |
| Length from muzzle to vent..... | 2 | 8.5 |
| " " " axilla..... | 2 | 4 |
| " " " ear..... | | 9 |
| " " " orbit..... | | 4 |
| " of hind limb..... | | 14 |

Australia. Mus. Jardin des Plantes, in ex.

This species is nearest the *Pl. duvaucelii* D. and B.; the differences may be readily determined by comparison with Günther's description in Reptiles Brit. India.

PTENOPUS MACULATUS Gray, Proc. Zool. Soc., London, 1865, 640.

Character genericus.—Toes with transverse series of very narrow, simple plates beneath. Posterior toes all turned forwards, with a series of long processes forming a fringe on each side; posterior claws issuing from above a broad parallelogrammic lamina. No femoral pores. Ears distinct. Nostril pierced in a single plate. Eyelids each half developed.

This genus is near to *Stenodactylus* Cuv. and *Spatalura* Gray, but differs markedly from both. The tail is not flattened and fringed as in *Spatalura*, while the terminal plates of the toes and single nasal plates are marked characters.

As Dr. Gray referred this genus to the Agamidæ I was induced to make an examination of the skeleton. As a result of this, I am satisfied that it belongs to the suborder of the *Nyctisaura* and the family *Geconidæ*. In evidence for this I append the following characters: 1. The dentition is pleurodont. 2. The parietal bones are separate. 3. The vertebræ are amphicoelous. 4. There is no subarticular bone. 5. The coronoid process of the mandible is not produced posteriorly. As characters of a higher or a lower significance the following may be added. The angular bone is distinct, there are four abdominal ribs, and three attached by long hæmapophyses to the posterior margin of the xiphisternum. The dentary bone is prolonged below unusually far posteriorly, i. e., to half way between the coronoid and articular processes.

Character specificus.—Head large, slightly compressed. Muzzle short, obtuse. Nasal plates two, forming a round disc, which is only in contact with the nostril and first labial, and separated from its fellow by a granule. This disc has its posterior third separated from the remainder by a suture; the nostril is in the anterior plate near the suture. Rostral not fissured, broader than high. Superior labials longer than high, large, seven on each side. Inferior seven (to opposite sixth superior) narrow, longitudinal. Symphyseal prominently rounded below, broader than high. No infralabials; gulars not smaller.

Dorsal scales equal, hexagonal, flat; nuchals minute, occipitals, frontals and nasals a little larger than dorsals, flat. Caudals equal to dorsals, flat, whorled. Tail vertically flattened at the end. Fingers and toes long, slender; former lengths 5—1—2—4—3; toes 1—5—2—3—4. Fingers not fringed; claws long, compressed, not concealed, but with a smooth basal sheath. The posterior toes are entirely different, in the long fringes, terminal plates, and the perfectly straight spine-like claws, which project from the middle of the end of each plate; the arrangement is a little like the body of a slender *Oniscus*, whence the name of the genus. The long cross-plates are not serrate, but are rigid; they are separated from the series of fringe-like scales by some series of granules. The tail is slender, short, and slightly compressed. No tubercles at base. Vent with a short fringe all round.

1868.]

| | In. | Lin. |
|------------------------------|-----|------|
| Total length | 3 | 6 |
| Length to vent | 2 | 1 |
| " " axilla | | 11 |
| " " ear | | 5.2 |
| " " orbit | | 2 |
| " " of hind limb | | 12.5 |
| " " foot | | 6 |
| Width of head at ears | | 5 |

Color.—Above light gray, with a rose shade on the neck and nape. Five pairs of irregular black annuli, one on each side the vertebral line, from rump to nape. These are more or less broken, especially anteriorly. They are replaced by scattered linear spots on the top of the head. The arrangement reminds one of that seen in the *Felis uncia*. Seven pairs of spots on the upper surface of the tail form cross-bars. Labial plates brown edged; below everywhere delicate straw color.

Habitat at Cape of Good Hope. No. 725, Mus. Comparative Zoology, Cambridge, Mass.

This interesting little Saurian is furnished with a large calcareous mass on each side the neck behind the os quadratum, which gives its head an appearance of length. It is no doubt an inhabitant of a sandy region, judging by its color and the structure of its hind feet, which appear to be adapted for excavating. It is no doubt allied to the *Stenodactylus garrulus* of Smith, but differs in numerous respects from the description of the latter author.

LETHEOBIA PALLIDA Cope, gen. et sp. nov. Typhlopidae.

Char. gen.—This genus differs from Typhlops in the subdivision of its ocular plate into two scales similar to those of the body; the superciliary plate is also undistinguishable from the latter. There appears to be no eyes. Superior labials three.

This genus is between Typhlops and Helminthophis Peters, differing from the latter in its erect nasal plate, with nostril on the superior suture. The *Onychocephalus caecus* Duméril, from Gaboon, appears to belong to this genus; the two species may be distinguished as follows:

Muzzle obtuse; rostral very wide, largely in contact with the superciliary plates; nasal large..... *L. pallida*.
Muzzle transversely acute; rostral not reaching to superciliaries; nasal minute..... *L. caeca*.

Char. specif.—Rostral subquadrate viewed from above, nearly as broad as long, in contact nearly equally with three scales above the fronto-nasals, viz., the frontal and two superciliaries. The subocular a little larger than the ocular; behind these a series of seven scales from the rictus to the median row, on each side. Preocular and fronto-nasal of equal width, the latter sending a very narrow point to the second labial behind the wider nasal. Nostril very near the rostral suture. Tail as long as width of head, acuminate. Scales equal, in twenty-two longitudinal rows. Form quite slender. Length 6 in. 3.5 lines; diameter at middle 1.25 lines. Color pale flesh-color.

Habitat.—Zanzibar. Presented by C. Cooke to the Essex Institute, Salem, Mass. (Mus. 504.) It was taken from a well. Mus. Acad. Nat. Sci. Philada.

THRASOPS CITRINUS Cope, sp. nov.

Body slender, compressed, tail short for the genus. Gastrosteges rounded and elevated on the sides. Scales in seventeen rows, poreless, all strongly keeled; the median more lanceolate; the surface of all finely longitudinally striate. Head quite distinct; muzzle not long, flat, truncate; canthus rostralis straight, angulate, lores plane. Supranasals a little longer than broad; frontal elongate, not concave laterally, occipitals a little longer. Post-frontals descending to labials, no loreal; oculars 1—3. Superior labials nine,

[Dec.

fourth, fifth and sixth in orbit, last three longer than high; temporals 1—2. Ten inferior labials, postgenials longer than pregenials.

Total length 23.5 in.; to vent 17 in.; to rictus oris 7 lin.; to orbit 1.5 lin. Gastrosteges 197, urosteges 105.

Yellowish-brown above, gastro- and urosteges rich yellow. Top of head brown, lips paler, the upper edges of the plates light, continuing into a streak to belly.

From the Seychelle Islands; found by U. S. consul Pike. Mus. Acad. Nat. Sciences.

Notes on some points in the Structure and Habits of the Palæozoic CRINOIDEA.

BY F. B. MEEK AND A. H. WORTHEN,

Of the State Geological Survey of Illinois.

Through the kindness of Mr. Charles Wachsmuth, of Burlington, Iowa, we have recently had an opportunity to examine some unique and exceedingly interesting specimens of Carboniferous Crinoids, showing parts of the structure of these animals, in some instances, never before observed, so far as we are at this time informed. In a few instances, these specimens show internal organs entirely free from the matrix, and although like all the other solid parts of these curious creatures, composed of numerous calcareous pieces, really surpassing in delicacy of structure the finest lace-work, and so frail that a touch, or even a breath, might almost destroy them.* Some of these specimens we propose to notice here, but, before proceeding to do so, we avail ourselves of this opportunity to express our thanks to Mr. Wachsmuth for the zeal, industry, skill and intelligence he has brought to bear, in collecting and preparing for study, such an unrivaled series of the beautiful fossil Crinoidea of this wonderfully rich locality. Some idea of the extent of his collection of these precious relics may be formed, when we state that of the single family *Actinocrinidae* alone, after making due allowance for probable synonyms, he must have specimens of near 150 species, or perhaps more, and many of them showing the body, arms and column.

It is also due to Mr. Wachsmuth, that we should state here that he is not a mere collector only, but that he understands what he collects, and knows just what to collect, as well as how to collect.

Below we give substantially some notes of observations made in his collection, followed by some remarks on other specimens at Springfield:

1. *Synbathocerinus*, Phillips. Some of Mr. Wachsmuth's specimens of a species of this genus show that it is provided with a long, slender, pipe-stem like ventral tube, or proboscis, apparently equaling the arms in length. Also, that a double row of minute alternating marginal pieces extends up within the ambulacral furrows of the arms, apparently all their length. We are not aware that these characters have been hitherto noticed in any of the publications on this genus. It will be seen, however, farther on, that minute marginal pieces probably occupied the furrows along the inner side of the arms of other types of Crinoidea, as well as this.

2. *Joniasteroidocrinus*, Lyon and Casseday. Some unusually fine specimens of the typical species of this genus (*G. tuberosus*) in Mr. Wachsmuth's collection, from Crawfordsville, Ind., show the slender pendent arms much more distinctly than any we had before seen, and from these it seems evident that these arms are stouter than we had supposed, and that there are not more than five or six of them to each of the ten openings. In the specimen figured by us on page 220 of the second volume of the Illinois Reports, these arms were only imperfectly seen by working away, with great difficulty, the hard matrix be-

* By Mr. Wachsmuth's permission, we have prepared for future publication, drawings of all of these instructive specimens.

tween two of the produced rays of the vault, which we have termed pseudo-brachial appendages, or false arms. In clearing away the matrix of this specimen, we had cut just far enough to expose the edges of the arms on each side of the deep ambulacral furrow, so that each of these edges presents the appearance of being a separate and distinct, very slender arm, composed of a single series of pieces, and without any ambulacral furrow on the outer or ventral side; whereas there is a well-defined ambulacral furrow, bearing the tentacula along its margins, on the outer side of the arms, and when the matrix is removed from these ambulacral furrows, the arms can be seen to be composed each of a double series of small alternately-arranged pieces. It is barely possible that in specimens of this species with the arms *perfectly preserved*, that the ambulacral furrows may be covered on the outer or ventral side by a double series of alternating pieces, and that the tentacula* may connect with little openings along each side, though there certainly *appear* to be only open furrows in the specimens examined.

It is worthy of note, in this connection, that there certainly are species, agreeing exactly in all other known characters with this genus, that have no open furrow along the outer or ventral side of the arms, which are distinctly seen to be round on the outer side, and show there a double series of interlocking pieces along their entire length, while the tentacula connect along the inner, or under side, as the arms are seen hanging down. This is clearly seen to be the case in a beautiful specimen of *G. typus* (= *Trematocrinus typus*, Hall) in Mr. Wachsmuth's collection, and we can scarcely doubt that in this species there is an open furrow on the inner (under) or dorsal side of the arms. If not, the arms must be tubular, in consequence of having the ambulacral canal closed all around, excepting at the points where the tentacula connect along each side.

3. *Cyathocrinus*, Miller. Specimens of this genus showing the vault (more properly the ventral disc) have very rarely been seen. In England a few examples have been found, and these have been supposed to show two openings, one central and another lateral; the latter, according to Prof. Philipps* and Mr. Austin's figures, being provided with a slender marginal tube, or so-called proboscis. Some of Mr. Wachsmuth's specimens, however, of *C. malvaceus* and *C. Iowensis*, Hall, showing the vault, have led us to doubt the existence of a central opening in the vault of this genus, when the specimens have this part entire. The specimen of *C. malvaceus* shows the remains of the usual narrow lateral proboscis, and also has an opening in the middle of the vault, but from the appearance of this opening, as well as from the structure of the vault of a specimen of *C. Iowensis*, in which this opening is closed, we can scarcely doubt that it was also closed in the specimen of *C. malvaceus*, when entire. The remaining parts of the vault of the *C. malvaceus* mentioned consist of only five comparatively large pieces, alternating with the upper inner edges of the first radial pieces,—the one on the anal side being larger than the others, and forming the base of the inner side of the proboscis. These five pieces connect with each other laterally, and extend inward some distance, but not so far as to meet at the centre, where there is a subsemicircular opening, nearly as large as that in the remaining base of the proboscis. Along each of the sutures between the five vault pieces mentioned, a comparatively large furrow extends inward from each arm-base to the central opening. These we regard as continuations of the ambulacral furrows from the arms, though there is also a minute opening at each arm base, passing directly downward into the cavity of the body, which was probably for the passage of the arm-muscles.

Looking at this specimen alone, one would naturally suppose there must

* We use the term tentacula here in the sense it is generally used by palaeontologists, with reference to the delicate pinnulae along the arms of Crinoids, and of course not as applying to the minute fleshy organs along the ambulacral furrows, usually termed tentacles by those who have investigated the recent Crinoids.

have been, during the life of the animal, two distinct openings in the vault, as appears to be the case in the specimen of *C. planus*, Miller, figured by Prof. Phillips and Mr. Austin. But on examining the specimen of *C. Iowensis* mentioned above, we find that it shows the base of the small lateral proboscis, with the five principal vault-pieces alternating with the first radials (the one on the anal side being larger than the others), and the same ambulacral furrows extending inwards from the arm-bases, all exactly as in the *C. malvaceus*. But here we find the central opening undoubtedly closed by several vault pieces, while the ambulacral furrows, extending inward from the arm-bases, pass in under these central pieces, and are themselves occupied, or covered, by a double series of alternating, very minute pieces, which probably also extend on, all the way up the ambulacral furrows of the arms as marginal pieces.

From our examinations of these two specimens, which are the only examples of the genus we have seen, showing the vault pieces, and seem to be typical forms of the genus in all other respects, we are strongly inclined to think the specimen of *C. planus*, figured by Prof. Phillips and Mr. Austin, has had these central vault pieces removed by some accident. The fact that these pieces in the specimen examined by us, in Mr. Wachsmuth's collection, seem not to be deeply implanted between the five larger surrounding pieces mentioned, but rather rest, as it were, partly upon the narrow bevelled points of the inner ends of the latter, between the ambulacral furrows, so as to allow room for these furrows to pass under, would render them less firm, and more liable to be removed by any accident, and may possibly account for their absence in the English specimen mentioned.

In regard to the pieces covering the central part of the vault, and which, from the way they are arranged for the ambulacral furrows to pass under them, were apparently more liable to be removed than the others, we would remark that they do not present the prominent appearance, and uniformity of size and form, of the movable pieces composing what is often called the ovarian pyramid in the Cystids, but certainly have all the appearances of true fixed vault pieces, and scarcely project above the others surrounding them. Consequently we cannot believe it at all probable that this genus had a central mouth, opening directly through the vault; though its ambulacral canals evidently converged from the arm-bases to the middle of the vault, partly above the outer vault pieces, and under those composing the middle of the vault. That these furrows terminated at the entrance of the alimentary canal, under the middle of the vault, as those of *Comatula* converge to the mouth, in the same central position, is highly probable; and, as will be seen further on, we are much inclined to believe that the minute organisms upon which we are led, from analogy, to think these animals subsisted, were conveyed to the entrance of the alimentary canal along the ambulacral furrows, without the agency of any proper mouth, opening directly through the vault. Hence we think it probable that the small tube, usually called the proboscis, situated near the posterior side of the ventral disc, rather corresponds to the tubular anal opening similarly situated in *Comatula Mediterranea*.

From our description of the vault of these species, it will be seen to present considerable similarity to that of *Crotalocrinus rugosus*, excepting that in that genus, owing to its great number of arms, the ambulacral furrows, or canals, bifurcate several times between the middle of the vault and the arm-bases, while in *Crotalocrinus* there is no lateral proboscis, nor, apparently, even any visible opening, judging by the figures we have seen, though we suspect it may have a small opening at the periphery of the ventral disc, on the posterior or anal side. In the group of depressed *Platycrini* for which Troost proposed the name *Cupellærinus* we observe a somewhat similar vault, at least in some of the species; also in *Coccoerinus*. In such forms there would seem to be, as it were, an intermediate gradation between the modern Crinoids and the prevailing Palæozoic types, as has been pointed out by Mr. Billings.

4. *Convolved support of the digestive sack, in the Actinocrinidæ.* The presence
1868.]

of a large convoluted body, resembling in form the shell of a *Bulla* or *Scaphander*, within the body of several types of the *Actinocrinidae*, was noticed by Prof. Hall in vol. xli, p. 261 of the Am. Journ. Sci., in 1866, though he made no suggestions there in regard to the functions it probably performed in the internal economy of these animals. In the second volume of the Illinois Geological Reports, published soon after, we figured, on page 191, a specimen of *Strotocrinus*, with this body seen in place, and stated that we regarded it as having been connected with the digestive apparatus of the animal.

Both in Prof. Hall's and our own remarks, this organ was spoken of as a convoluted *plate*. This, however, we now know is not strictly correct, for although composed of hard calcareous matter, and in some species somewhat dense in structure, it seems to be always constructed of a great number of minute pieces, and generally has a more or less open or porous texture; while in some cases it presents the appearance of an exceedingly delicate net-work. It seems never to be attached to the bottom of the visceral cavity, though it extends down nearly to the bottom. It is open at both ends (the opening at the lower end being generally smaller than the other), and is placed with its longer axis nearly so as to coincide with that of the body of the Crinoid. In some species it is more or less dilated at the upper end, while in others it is contracted at both ends, so as to present, as above stated, the form of the shell of a *Bulla*. It has apparently no columella, but is more or less loosely convoluted, with a spiral ridge descending the interior, and sometimes another ascending the exterior. Its walls are generally of moderate thickness, but they often appear to be thicker than natural, in consequence of the presence of inorganic incrustations, of calcareous or silicious matter, which also disguise its real structure.

In *Actinocrinus Verneuilianus*, Shumard, this body is narrow below, and sub-cylindrical above to the top, which is slightly dilated. The small opening at the lower end has a thickened rim, which passes around spirally, so as to ascend the outside, as a rather stout ridge, all the way to the top, making nearly two turns, and apparently also forming a rim partly around the top. The surface of the whole organ, as well as of its external spiral ridge, has the usual rough appearance, and when fragments of it are held up, so as to be examined by transmitted light, through a good pocket-glass, it is seen to be composed of a great number of very minute polygonal pieces, varying somewhat in form and size. When these pieces are examined under a magnifier, by reflected light, they show shining facets, like crystals, though they are evidently not surface incrustations, but actually compose the walls, or substance of the organ itself. No pores or meshes were observed passing through the walls of this organ in this species, in which it appears to be more than usually dense.

In another specimen in Mr. Wachsmuth's collection, apparently of *Actinocrinus proboscidealis*, this organ, as seen with one or more of the outer turns removed, has an oval or subelliptic form, being contracted and twisted at both ends, so as to present very nearly the appearance of the shell of some species of *Orulium*. Its walls are quite thin, and seem to form more convolutions than in any other species in which we have had an opportunity to examine it. As seen by the aid of a magnifier by transmitted light, it presents a very beautiful appearance, being composed of a great number of minute pieces, with numerous openings passing through between them. The little pieces and the openings between them, are of nearly uniform size, and arranged so that there are usually one or two of the former intervening between any two of the openings.

Another of Mr. Wachsmuth's specimens of *Actinocrinus securus*, Hall, has one side of the body removed so as to show about two thirds of the convoluted organ, the upper part of which is broken away. The part remaining has a short wide subcylindrical form, with a rather broad, obliquely truncated lower end, which is not tapering, as in the other species. Under a magnifier it is seen to be composed of an extremely fine net-work, far surpassing, indeed, in delicacy

[Dec.

of structure, the finest laces that it is perhaps within the power of human skill to fabricate; and as it is entirely free from any surrounding matrix, excepting at one side below, the specimen has to be handled with great care, as a mere touch of this delicate part would probably cause it to fall into hundreds of minute fragments. On examining it under a magnifier, the little bars of which it is composed are seen not to intersect each other at any uniform angle, but anastomose, so as to impart a kind of irregular regularity, if we may so speak, to the form and size of the meshes. Of these little bars there are two sizes, the larger forming the larger meshes, while within the latter a smaller set of processes extend partly or entirely across, so as to form more minute meshes; the whole presenting a beautiful appearance, of which it would be difficult to convey a correct idea by a mere description alone, without the aid of figures.

From analogy, judging from what is known of the internal structure of the recent genus *Comatula*, in which several authors have noticed a reticulated calcareous structure secreted within the tissue of the softer parts of its alimentary canal, we may infer that this convoluted organ was, as it were, a kind of frame work, secreted for the support of the digestive sack, which was probably more or less convoluted in the same way in many, if not all of the Palæozoic Crinoids, though not apparently, in all cases, endowed with the power of secreting a sufficient dense structure of this kind to leave traces of its existence in a fossil state.

So far as we are at this time informed, this organ has yet been very rarely observed in any other family than the *Actinocrinidæ*, though it was probably more or less developed in various other groups. In one instance Mr. Wachsmuth found it in a *Platycrinus*, but here it seems to be, in the specimen found, merely a spongy mass, not showing very clearly the convoluted structure. Some traces of what was supposed to be something of this kind were also observed by him in one of the Blastoids.

5. *Ambulacral canals passing under the vault in the Actinocrinidæ.* In the third and fourth Decades of descriptions and illustrations of the Canadian Organic Remains, Mr. Billings, the able palæontologist of the Geological Survey of the Canadian provinces, gives some highly interesting and instructive remarks on the ambulacral and other openings of the Palæozoic Crinoids. In these remarks he noticed, at length, some striking differences between the vault, or ventral disc, of these older types, and that of the few living examples of this extensive order of animals. That is, he noticed the facts, that while in the living *Comatula* and *Pentacrinus*, the ambulacral canals are seen extending from the arm-bases across the surface of the soft skin-like ventral disc, to the central mouth, and these genera are provided with a separate anal opening, situated excentrically between the mouth and the posterior side, that in the palæozoic Crinoids the ventral disc is very generally, if not always, covered by close-fitting, solid plates, showing no external traces whatever of ambulacral furrows extending inward from the arm-bases; and that in nearly all cases they are merely provided with a single excentric, or subcentral opening, often produced into a long tube which, like the vault, is made up of solid plates. He showed that there is no evidence whatever that the ambulacral canals, in these older types, were continued along the surface of the vault from the arm-bases to the only opening, whether subcentrally or laterally situated, and that in cases where this opening is produced in the form of a greatly elongated proboscis, or tube, such an arrangement of the ambulacra would be almost a physical impossibility. Hence he concluded that the ambulacral canals must have passed directly through the walls of the body at the arm-bases; and he gave several figures of various types, showing openings at the base of the arms, through which he maintained that the ambulacra must have passed to the interior of the body from the arms.

Although these arm-openings had long been well known to all familiar with our numerous types of western Carboniferous Crinoids, in which they are very
1868.]

conspicuous, and we had never entertained any other opinion in regard to them, than that they are the only passages of communication that could have existed between the softer parts occupying the ambulacral furrows of the arms, and the interior of the body, Mr. Billings was the first author, so far as we are at this time aware, who called especial attention to them in this regard. We regret that we have not space to quote a portion, at least, of his remarks on this subject, and would advise the student to read attentively the whole of both of his articles alluded to.

The specimens at Mr. Billings's command enabled him to trace the courses of the ambulacral canals from the arms, through the walls of the body at the arm-bases, and to ascertain the additional fact that, after passing through the walls, they seemed to have turned upward; but beyond this he had not the means of tracing them farther.

A single specimen of *Actinocrinus proboscoidialis*, however, in Mr. Wachsmuth's collection, is in a condition (thanks to the great skill of that gentleman, and the exceedingly fortunate state of preservation, by which its delicate internal parts remain almost entire, and without any surrounding matrix) to throw much additional light on this subject. By very dextrous manipulation, Mr. Wachsmuth succeeded in removing about half of its vault, so as to expose the internal parts, in place, and in an excellent state of preservation. The convoluted organ already described in other species is in this comparatively large, subcylindrical in the middle, apparently tapering at the lower end, and a little dilated at the upper extremity. It seems to be rather dense, and shows the usual rough appearance, but as we had no opportunity to examine any detached fragments of it by transmitted light, we did not determine whether or not it has pores passing through it, though it probably has, at least when entirely free from any inorganic incrustation. Its slightly dilated upper end seems to stand with its middle almost, but apparently not exactly, under the middle of the nearly central proboscis of the vault; while at the anterior side of its upper margin, and a little out from under the proboscis, it shows remains of a kind of thickened collar, which we found to be composed of minute calcareous pieces. From this there radiate five ambulacra, composed of the same kind of minute pieces as the collar itself, each ambulacrum consisting of two rows of these minute pieces alternately arranged. They are each also provided with a distinct furrow along their entire length above. As they radiate and descend from their connection with the top of the convoluted framework of the digestive sack, they all bifurcate, so as to send a branch to each arm-opening, those passing to the posterior rays curving a little at first above, so as not to pass directly under the proboscis. These ambulacra, although passing along obscure furrows in the under side of the vault, which are deepest near the arm-openings, are not in contact with the vault, or visibly connected with any other parts than the top of the convoluted digestive sack, and the outer walls at the arm-openings. Each of their subdivisions can be traced into an arm-opening, and it is very probable that they continued on out the ambulacral furrows of the arms and tentacula. At one point in one of these ambulacral canals, beneath the vault, some evidences of the remains of two rows of minute pieces were observed alternating with the upper edges of those composing the under side of these canals, and thus apparently covering them over. The condition of the parts is such, however, as scarcely to warrant the assertion that this was really the case, though we are much inclined to think it was. If so, these canals must have been, at least under the vault, hollow tubes, formed of two rows of pieces below, and two above, all alternately arranged.

We are not aware that any evidences of the existence of these delicate ambulacral canals, composed of minute calcareous pieces, and passing beneath the vault from the arm-openings to the summit of the convoluted digestive sack, have ever before been observed in any Crinoid, recent or extinct; and we can but think it probable, that the extremely rare combination of circumstances

[Dec.

that brought them to light in this instance may not again occur for centuries to come, with regard to another specimen. That they correspond to the ambulacral canals seen extending from the arm-base to the mouth, on the *outside* of the ventral disc in *Comatula*, is clearly evident.

The presence of furrows radiating from the central region of the under side of the vault to the arm-openings, in various types of palæozoic Crinoids, must have been frequently observed by all who have had an opportunity to examine the inner surface of this part. Messrs. deKoninck and Lehon figure a portion of the vault of *Actinocrinus stellaris*, in their valuable *Recherches sur les Crinoïdes du Terr. Carb. de la Belgique*, pl. iii, fig. 4 f., showing these furrows, which they seem to have regarded as the impressions left by the muscles of the viscera. The inner surface of the vault of most of our western Carboniferous Crinoids is known to have these furrows more or less defined, either from specimens showing this inner surface, or from natural casts of the same. In some instances they are very strongly defined from the central region outward to the arm-bases, to each of which they send a branch. In *Actinocrinus ornatus*, Hall, for instance, they are generally so strongly defined as to raise the thin vault into strong radiating ridges, separated by deep furrows on the outer side. In *Strotoerinus*, the vault of which is greatly expanded laterally, and often flat on top, these internal furrows, in radiating outward, soon become separated by partitions, and as they go on bifurcating, to send a branch to each arm, they actually assume the character of rounded tubular canals, some distance before they reach the arm-bases.

That these furrows or passages of the inner side of the vault were actually occupied during the life of the animal by the ambulacral canals as they radiate from the top of the convoluted digestive sack to the arm-openings, we think no one will for a moment question, after examining Mr. Wachsmuth's specimen of *Actinocrinus proboscidiæ*, which we have described, showing all these parts in place. It is also worthy of note, that in all the specimens of various types in which these furrows of the under side of the vault are well known, whether from detached vaults, or from casts of the interior of the same, they *never converge directly to the opening of the vault, but to a point on the anterior side of it*, whether there is a simple opening or a produced proboscis. The point to which they converge, even in types with a decidedly lateral opening of the vault, is always central or very nearly so, and even when the opening is nearly or quite central, the furrows seem to go, as it were, out of their way to avoid it, those coming from the posterior rays passing around on each side of it to the point of convergence of the others, a little in advance of the opening. That the ambulacral canals here, under this point of convergence of the furrows in the under side of the vault, always came together and connected with the upper end of the convoluted frame-work of the digestive sack, we can scarcely entertain a doubt.

Now in looking at one of these specimens, especially an internal cast of the vault, showing the furrows (or casts of them) starting from a central, or nearly central point, and radiating and bifurcating so as to send a branch to each arm-base, while the opening or proboscis of the vault (or the protuberance representing it in the cast) is seen to occupy a position somewhere on a line between this central point from which the furrows radiate and the posterior side, one can scarcely avoid being struck with the fact, that this point of convergence of the ambulacra, under the vault, bears the same relations in position to the opening of the vault, that the *mouth* of a *Comatula* does to its *anal* opening. And when we remember that eminent authorities, who have dissected specimens of the existing genus *Comatula*, maintain that these animals subsisted on microscopic organisms floating in the sea-water, such as the *Diatomaceæ*, minute *Entomostraca*, etc.,* which were conveyed to the mouth

* Bronn mentions the fact (*Klassen des Thierreichs. Actinozoa*, II, p. 211), that the remains of *Diatomaceæ*, of the genera *Navicula*, *Actinocyclus* (*becinodiscus*), and of minute *Entomostraca* were found in the stomach of *Comatula*, and suggests that, when such objects, in

along the ambulacral canals, perhaps by means of cilia, we are led from analogy to think that the palæozoic Crinoids subsisted upon similar food, conveyed in the same way to the entrance of the digestive sack. If so, where would there have been any absolute necessity for a mouth or other opening directly through the vault, when, as we know, the ambulacral canals were so highly developed under it from the arm openings to the entrance into the top of the alimentary canal? Indeed it seems at least probable, that if the soft ventral disc of *Comatula* had possessed the power of secreting solid vault pieces, as in most types of palæozoic Crinoids, that these vault pieces would not only have covered over the ambulacral furrows, as in the palæozoic types, but that they would also have hermetically covered over the mouth, and converted the little flexible anal tube into a solid calcareous pipe, such as that we often call the proboscis in the extinct Crinoids.

From all the facts therefore now known on this point, we are led to make the inquiry whether or not, in all the palæozoic Crinoids in which there is but a single opening in the vault—whether it is a simple aperture or prolonged into a proboscis, and placed posteriorly, subcentrally, or at some point on a line between the middle and the posterior side—this opening was not, instead of being the mouth, or both mouth and anus as supposed by some, really the anal aperture alone; and whether in these types the mouth was not generally, if not always, hermetically closed by immovable vault pieces, so far as regards any direct opening through the vault?

We are aware of the fact, that at least one apparently strong objection may be urged against this suggestion, and in favor of the conclusion that the single opening seen in these older Crinoids was the mouth, or at least performed the double office of both anal and oral aperture. That is, the frequent occurrence of specimens of these palæozoic species, with the shell of a *Platyceras* in close contact by its aperture, either with the side or the vault of the Crinoid, and not unfrequently actually covering the only opening in the vault of the latter, so as to have led to the opinion that the Crinoid was in the very act of devouring the Mollusk at the moment when it perished.

Amongst the numerous beautiful specimens of Crinoids found in the Keokuk division of the Lower Carboniferous series at Crawfordsville, Indiana, there is one species of *Platycrinus* (*P. hemisphæricus*), that is so abundant that probably not less than two hundred, and possibly more, individual specimens of it have been found there by the different collectors who have visited that noted locality; and, judging from those we have seen, apparently about one-half of these were found with a moderate sized, nearly straight, or very slightly arched and conical *Platyceras* (*P. infundibulum*), attached to one side by its aperture, between the arms of the crinoid, and often so as to cover the single lateral opening in the vault of the same.* From the direction of the slight curve of the apex of the *Platyceras*, it is also evident that it is always placed in such a manner, with relation to the Crinoid, that the anterior side of the Mol-

floating in the sea-water, came in contact with the ambulacral furrows of the pinnula, they were conveyed along these furrows to those of the arms, and thence in the same way into the mouth. He ridicules the idea, sometimes suggested, that the food may have been handed by the pinnule or arms directly to the mouth.

Dujardin and Hupé also state (Hist. Nat. des Zoophytes Echinod., p. 18), that the living *Comatula* was "nourished by microscopic *Alge* and floating corpuscles, which the vibratile cilia of the ambulacra brought to the mouth." That they may have sometimes swallowed a larger object, that accidentally floated into the mouth, however, is not improbable, and would not, if such was the case, by any means disprove the generally accepted opinion that these animals received their food almost entirely through the agency of their ambulacral canals.

* We at one time thought these shells attached to the side of this *Platycrinus* to be out of reach of the opening, or supposed mouth, because we had not seen specimens showing the position of the opening in this species, and had supposed, from its similarity to *Platycrinus granulatus*, Miller, and other species without a lateral opening, that such was also the case with this. We have since seen specimens, however, showing that it has a lateral opening, and therefore belongs to the group *Pleurocrinus*, so that it is probable these shells often cover this opening.

[Dec.

lusk was directed upward, when the vault of the Crinoid was turned in that direction.* A species of *Goniasteroidocrinus* (*G. tuberosus*, Lyon and Casseday), found at the same locality, also has frequently a *Platyceras* attached to the top of its nearly flat vault, so as to cover the only opening in the same. It is worthy of note, however, that it is always another, subspiral, *Platyceras* (very similar to *P. æquilaterum*), that we find attached to this Crinoid, so that here at least, it would seem that each of these two Crinoids has its own particular species of *Platyceras*.

In all of these, and numerous other examples that might be mentioned, it is worthy of note that it is to species of Crinoids with a simple opening in the vault, and not to any of those with a produced proboscis, that we find these shells attached in this way;† and it is so rarely that we find shells of any other genus than *Platyceras*, apparently attached to, or in contact with, the body of a Crinoid, that it seems probable where other shells are occasionally so found, that their connection with the Crinoid may be merely accidental. If it could be established as a fact, that these Crinoids were actually devouring these Mollusks, by sucking out, or otherwise extracting and swallowing their softer parts, in any instance where they have been found with a shell attached over the opening of the vault, this would, of course, establish the fact that this opening is the mouth, or, at least, that it must have performed the office of both oral and anal aperture. But to say nothing in regard to all that is known of the habits and food of the recent Crinoids being so directly opposed to such a conclusion, the fact that so large a proportion as nearly one-half of all the individuals of some species should have died at the precise moment of time when they were devouring a *Platyceras*, and should have been embedded in the sediment and subsequently fossilized without separating from the shell, seems, to say the least of it, very improbable.

And it is even more difficult to understand upon what principal an animal with its viscera incased in a hard unyielding shell, composed of thick, close-fitting calcareous pieces, and with even its digestive sack, as we have reason to believe, at least to some extent, similarly constructed, could have exerted such powers of suction as to be able to draw out and swallow, through an aperture in its own shell, often less than one-tenth of an inch in diameter, the softer parts of a mollusk nearly or quite equal in volume to the whole of its own visceral cavity. That they ever did so, however, becomes still more improbable, when we bear in mind the fact, that the animal supposed to have performed this feat, lived, at least during the whole of its adult life, attached to one spot by a flexible stem, that only allowed it a radius of a foot or so of area to seek its prey in; while the mollusk it is supposed to have so frequently devoured, from its close affinities to the genus *Capulus*, may be supposed to have almost certainly lived most of its life attached to one spot.‡ In such a case, why

* Prof. Richard Owen has noticed, in his Report on the Geological Survey of Indiana, p. 364 (1862), the frequent occurrence of a *Platyceras* attached to this same *Platycrinus*, at this locality, and proposed to name the *Platyceras* *P. pabulocrinus*, from the supposition that it formed the chief food of these Crinoids. It is probable that the *Platyceras* for which he proposed this name, is the same we named *P. in/undibulum*, but as he gave no description of the species, and but an imperfect figure, we cannot speak positively as to its identity. Prof. Hall has also proposed the name of *P. subrectum* for this Crawfordville *Platyceras*, but he had previously used the same name for a very different, New York, Devonian species of this genus.

Prof. Vandell and Dr. Shumard have also figured in their paper entitled "Contributions to the Geology of Kentucky," a specimen of *Acrocrinus*, with a very similar *Platyceras* apparently attached to its vault.

Amongst all the numerous Crinoids found at Burlington, Iowa, we are aware of but a single instance of one being found with a *Platyceras* attached, and that is a specimen of *Actinocrinus ventricosus* in Mr. Wachmuth's collection, which has a crushed shell of a *Platyceras* connected with its vault.

† Possibly due to the fact, that in species with a proboscis there is much less room for attachment to its vault.

‡ Most of the best European authorities on palæontology refer these shells even to the existing genus *Capulus*.

should the Crinoid have so frequently left the *Platyceras* to grow within its reach to nearly its adult size before devouring it? But if from some unknown cause it should have done so, by what means could the Crinoid have pulled loose the Mollusk (which from analogy we may reasonably suppose held with some degree of tenacity to its place of attachment), and placed it with the aperture of its shell over the opening supposed to be its own mouth? That it could have used its arms and tentacula as prehensile organs, in this sense, is extremely improbable from their very structure, so much so indeed that few if any of the best authorities who have investigated the recent Crinoids, believe that they ever used these appendages to hand directly to the mouth, even minute organisms.*

But we believe the strongest argument against the conclusion that the Crinoids, so frequently found with the shell of a *Platyceras* attached to them, died while in the act of sucking out, or otherwise extracting the softer parts of these Mollusk, remains to be stated. In the first place, if such really was the nature of the relations between the Crinoid and the Mollusk, it is of course self-evident that the continuation of the life of the latter must have necessarily been of very short duration after it came in contact with the Crinoid. Yet we have the most conclusive evidence that such was not the case; but that on the contrary, in most if not all of these instances, the *Platyceras* must have lived long enough in contact with the Crinoid to have adapted the sinuosities of the margins of its shell exactly to the irregularities of the surface of the Crinoid.

We have taken some trouble to examine carefully a number of specimens of *Platycrinus hemisphaericus*, and *Goniasteroidocrinus tuberosus*, from Crawfordsville, Indiana, with each a *Platyceras* attached, and in all cases where the specimens are not too much crushed or distorted, or the hard argillaceous shaly matter too firmly adherent to prevent the line of contact between the shell and Crinoid to be clearly seen, the sinuosities of the lip of the former closely conform to the irregular nodose surface of the latter. Owing to the fact that in some cases the shell has evidently been forced by accidental pressure against the surface of the Crinoid, so as to become somewhat crushed, this adaptation is not always so clearly evident; but in most cases it is more or less visible, while in some it is strikingly manifest. In one instance of a *Platycrinus* now before us, with a *Platyceras* attached, as usual, to its side, between the arm-bases of two of its adjacent rays, and of rather larger size than those usually found attached to this species, the adaptation of the irregularities of its lip, so as to receive the little nodes and other prominence of the Crinoid, is so clearly manifest that a moment's examination must satisfy any one that the shell must have grown there. Being, as we stated, a larger individual than we usually see so situated, it not only occupies the whole of the interradial or anal space to which it is attached, but its lateral margins on each side coming in contact with the arm-bases of the Crinoid, as the shell increased in size, had formed on either side a profound sinus in its lip for the reception of these arms. These sinuses are not only in pre-

* In many instances it is clearly evident that it would have been an absolute impossibility for certain types of our Carboniferous Crinoids to have handled any object great or small, directly to the only opening through the vault. That is, where this opening is at the extremity of a straight rigid tube, often nearly twice the length of the arms, even to the extreme ends of their ultimate divisions. We are aware that some have supposed this tube, or proboscis, to have been flexible, and the Messrs. Austin even thought it was especially designed and used for the purpose of sucking out the softer parts of Polyps. If flexible, we might suppose that in those cases where it was so much longer than the arms, that it could have been curved so as to bring its extremity within reach of the ends of the arms; but although we have in a few instances seen this tube more or less bent, a careful examination always showed that, where this was not due to an accidental fracture after the death of the animal, it was caused by the plates composing it being on one side larger, or differently formed from those on the other, and evidently not to flexibility. We find the arms, which were evidently flexible, folded and bent in every conceivable manner, but the tube of the vault is, in nine cases out of ten, if not more frequently, when not accidentally distorted, found to be perfectly straight, or a little inclined to one side or the other.

cisely the *proper places*, but of exactly the *proper size and form* to receive the adjacent arm on each side; the entire adjustment being so exact, that it seems scarcely possible that the shell could have been removed during the life of both animals, and after the Mollusk had attained its present size, without either breaking its lip or breaking off the arms of the Crinoid. Unfortunately, in clearing away the rather hard argillaceous matrix, before the arrangement of the parts was clearly comprehended, these arms were broken away, but their stumps are still seen protruding from the sinuses, which are so deep as almost to present the appearance of isolated perforations, though it is evident, on a careful examination, that they are only deep emarginations extending up from the edge of the lip.

In looking at the sides of this *Platyceras*, which has the form of a very slightly arched cone,* and stands out nearly at right angles to the side of the Crinoid, it is easy to see, from abrupt curves in the lines of growth, along up its sides, on a line above the sinuses mentioned, that these sinuses commenced forming abruptly at points about half way up; and on measuring across between these points with a pair of dividers, the space between is found to coincide very closely with that between the inner sides of the arm-bases protruding from the sinuses. Hence it is evident that the shell had commenced forming these sinuses in its lip exactly at the period of its growth, when it had attained a breadth that brought the edges of its lip in contact with the arm-bases. After this, it had increased very little in *breadth* between the arms of the Crinoid, though it had grown somewhat wider above and below, and *nearly doubled its length*. Whether or not it covers the opening in the side of the vault of the Crinoid we are unable to say, since the folded arms (which are, as usual in these cases, well preserved) and adhering matrix, cover the vault. We have scarcely any doubt now, however, that the *Platyceras* does, in this, as in most of the other cases, actually cover the opening in the side of the vault of the Crinoid.

From the facts stated it is, we think, evident that these Mollusks actually lived long enough after their connection with the Crinoids, to which we find them attached, not only to have adapted the edges of their lip to fit the surface of the Crinoid, but to have generally increased more or less in size, and in some instances, at least, to have actually nearly or quite doubled their size. Admitting this to be the case—and we think there can be no reasonable doubt on this point—we can no longer believe that these Crinoids were preying upon the Mollusks; and we therefore think no well grounded arguments can be based upon the fact of their being so frequently found attached in the manner described, in favor of the conclusion that the opening in the vault of these Crinoids is the mouth.

But, if they were not in the habit of eating these Mollusks, it may be asked what could have been the nature of the relations between the two, that so frequently brought them together as we now find them? The first explanation that suggests itself is, that possibly the Mollusk may have been preying upon the Crinoid. But the fact, already stated, that these Mollusks evidently lived long enough attached to these Crinoids, as we have every reason to believe, during the life of the latter, to have at least increased the size of their shells considerably, if not indeed during their entire growth, is alone an almost insurmountable objection to such a conclusion. Doubtless, like other marine sedentary animals, these Mollusks, when very young, floated freely about in the sea, until they found a suitable station to attach themselves, where they remained during life. May they not, therefore, have been attracted to the bodies of Crinoids by the numerous little organisms brought in by the action of cilia, along the ambulacral furrows of the arms of the Crinoids, or in currents produced by the motions of the arms of the latter? The excre-

* It being the common species of *Platyceras* that is usually found attached to this *Platycrinus*.

mation matter of the Crinoid could doubtless have passed out under the foot of the *Platyceras*, supposing the opening in the Crinoid sometimes covered by these shells to have been the anus, but it is difficult to conceive how food could have passed in, if we suppose this opening to be the mouth.

On the Seed Vessels of FORSYTHIA.

BY THOMAS MEEHAN.

Forsythia suspensa Vahl., and *F. viridissima* Lindl., two Chinese plants, have I believe, never been known to produce perfect seed, though common in cultivation. The latter rarely produces capsules; the former bears capsules freely, but no perfect seed.

These two plants have strong specific differences; yet my studies in development, as published in papers in our Proceedings, lead me to believe them to have an unity of origin. Noticing last spring that the stamens in *F. suspensa*, and the pistil in *F. viridissima*, were relatively more highly developed, I supposed the two might possibly be, as we say practically, male and female forms of the same thing. I impregnated flowers of *F. viridissima* with pollen from *F. suspensa*, and for the first time had the opportunity of examining perfect capsules of this species. The seeds, however, though apparently mature, proved imperfect on dissection. There is no doubt but that *F. suspensa* conferred on the other the power to produce capsules,—why not the additional power of perfect seeds is a mystery,—though not more so perhaps than that it should itself be able to produce only seedless capsules. Another form is probably missing, necessary to fertilize the plant and furnish the wanting link to prove the hypothesis of a unity of origin.

But some useful facts proceed from the experiment. The capsule of *F. viridissima* I believe has never been described. Lindley, the author of the species, does not seem to have seen it. It is broadly ovate, sharp pointed, and wrinkled, carpels of a thin papery texture, bivalvate. Seeds resembling small grains of white wheat, wingless, developing upwards a swell as down from the funiculus, shining, and profusely pitted with small dots. The peduncles are rather shorter than the pods. *One capsule was four-celled, with seeds in each division.*

F. suspensa is variously described by different authors. Bunge says the capsule is "about four-seeded," Endlicher "few," and Zuccarini "numerous." The author makes the seeds "narrowly winged." I find the capsule narrowly lanceolate, ligneous, and verrucose, on pedicels double its length, composed of two carpels, in one of which I counted sixteen immature winged seeds; one, however, was fully developed, although as in the other form imperfect, and this was wingless, exactly resembling those of *F. viridissima* in all but color, which was a little darker.

The chief interest is the relation these capsules exhibit to Syringa and to the allied orders of Solanaceæ and Jasminaceæ. It was plain in the four-celled capsule of *F. viridissima* that placentous matter pushes out from the central axis in four directions, though usually the two alternates are destitute of ovules. When barren it is most highly developed. On perfect seeds it forms no margin; on imperfect ones a wing, until in Syringa, where the productive division bears only a single winged seed, the unproductive one is expanded into a long broad wing, pushing through the whole length of the incurved carpellary margins, cementing them closely together, and thus necessitating the peculiar dorsal dehiscence familiar in the common Lilac. A slight difference in the vigor of placentous development constitutes the chief cause of the differences in these three forms of capsule.

The polyspermous placentation of Forsythia indicates an approach to Solanaceæ, and the erect tendency of the seeds to Jasminaceæ.

[Dec.

Remarks on some types of Carboniferous CRINOIDEA, with descriptions of new Genera and Species of the same, and of one ECHINOID.

BY F. B. MEEK AND A. H. WORTHEN,

Of the Illinois State Geological Survey.

Since the publication of the second volume of the Illinois Geological Reports, in 1866, other engagements have, until recently, prevented us from attempting any further investigations of the Crinoidea, beyond the preparation of some specific descriptions for the third volume. On several occasions we have expressed the opinion, that the classification of these animals, as *entirely* based upon the number and arrangement of the pieces composing the walls of the body below the arms, without regard to the most *extraordinary* differences in other parts, is, to a considerable extent, artificial; and that when larger collections, containing perfect specimens, showing the whole structure of a greater number of species of various types could be obtained for study, considerable modifications in the limits of genera, as most generally understood, would be found necessary. Impressed with this opinion, we separated in the third volume of the Illinois Geological Reports and elsewhere, either as distinct genera, subgenera, or less important sections, various types that had already been named by different parties in this country and Europe, as distinct genera, but which had been almost entirely overlooked or neglected by most authors, while to a few other types we gave, for the first time, distinct names.

Having recently had an opportunity to study in Mr. Wachsmuth's collection at Burlington, Iowa, what we really believe to be by far the most extensive collection of finely preserved Carboniferous Crinoids ever brought together, either in this country or Europe, we have been more than ever impressed, not only with the importance of the separations we had previously admitted, but with the necessity for giving even greater prominence to some of those groups than we have hitherto done, as well as for making other divisions. It is only when we can study a great collection like this, in which specimens may be counted by hundreds, showing the whole structure of numerous species belonging to various genera, that it can be fully realized how readily we may arrange them into perfectly natural groups, distinguished in part by other characters as well as by the structure of the body. In addition to this, in attempting to classify such a collection as this by taking into consideration the structure of the body *only*, we soon find that we would often have to include in a single genus forms differing very widely, on as important *other* characters, as those distinguishing many of the universally admitted genera of other groups of *Echino-dermata*.

When once we have become familiar with the different groups, as separated by a careful study of the entire structure of these animals, it is surprising to see how readily we may generally separate them, even from very imperfect specimens, upon some seemingly unimportant characters scarcely ever noticed by those who give the widest limits to genera. That such divisions greatly facilitate the study of these fossils must also be evident to any one who will attempt to identify the numerous species of some allied groups contained in a large collection.

With regard to the new species described in this paper, as well as others that we expect to describe hereafter from the same horizon, it may be proper to state, that we have had the advantage of being able to compare them directly (assisted by Mr. Wachsmuth) with authentic specimens of very nearly all the described species from the Burlington rocks. Many of the original typical specimens we have here at hand in Springfield, while Mr. Wachsmuth has in his own collection good specimens of nearly all the described Burlington species. Many of his specimens are also types of species, while most of those that are not, have been identified from direct comparison by him and Mr. Niles and our-
1868.]

selves, with the original types in the possession of others at Burlington and here.

The fact that Mr. Wachsmuth is the only person (with the exception of occasional visitors) that has been collecting at Burlington during the last four or five years, and that during this time extensive excavations have been made in working the numerous quarries and in opening new streets in the Burlington rocks, has given him great advantages in collecting; consequently his collection may now be regarded as unrivaled in the number and perfection of specimens, as well as in the number of species.

Mr. Wachsmuth informs us that he also has many duplicates that he is willing to exchange for other Crinoids, or to dispose of in any way that may assist in affording him the means of increasing his collection.

Genus CYATHOCRINITES, Miller.

As properly restricted to true typical species, such as the *C. planus*, Miller and *C. mammillaris*, *C. calcaratus* and *C. bursa*, Phillips, the genus *Cyathocrinites* includes forms with a more or less globose (or perhaps rarely obconic) body, composed of thin pieces, which below the vault consist of the basal, subradial and first radial plates, and but a single anal piece that can be properly regarded as forming a part of the walls of the body below the top of the first radials. Of true interradials there are apparently none. The base consists of five pieces, all normally of the same form, and alternating with these there are five generally larger subradials, one of which, on the anal side, differs in form from the others, being truncated above for the support of the only anal piece inserted between two of the first radials. The five first radial pieces are comparatively large and alternate with the subradials all around.

The succeeding radials are all small, more or less rounded, or sometimes angular, and always free or form no part of the walls of the body, those of each ray being distinctly separated by more or less wide interradial spaces. The number of these free pieces varies from two to some six or seven to the ray, the number being generally different in the different rays of the same individual. The arms are slender, more or less bifurcating and rounded or sometimes angular, and always composed of a single series of pieces provided with a deep ambulacral furrow along the ventral or inner side, and apparently without tentacula (pinnulæ) along its margins. The column is generally if not always round and pierced by a small canal, and not divisible into five sections longitudinally.

The vault in this genus is always much depressed, never being extended upward in the form of a large poriferous trunk, or so-called proboscis, as we see in the typical forms of *Poteriocrinus*. It is very rarely preserved in the specimens as usually found, but according to Phillips' and Austin's figures of *C. planus* it would appear to be provided with a lateral proboscis, or, more properly as we think, anal tube and an apparent central oral aperture. From specimens of *C. malvaceus* and *C. lowensis*, however, which we have had an opportunity to examine in Mr. Wachsmuth's collection and have described in another place, we are satisfied that, in these species at least, which appear to be typical examples of the genus, the apparent central opening is closed by vault pieces, in perfect specimens. These central pieces, however, are more liable to be removed by any accident than the five larger surrounding pieces, because the latter are more deeply inserted, in order to permit the five rather large ambulacral canals, extending inward from the arm bases, to pass over them, or rather along the upper side of the sutures between them, while these furrows pass in under the pieces forming the centre of the vault, which are consequently less firmly fixed.

As we have not had an opportunity to examine the original typical specimens of *C. planus*, figured by Phillips and Austin, we of course cannot assert positively that the vault of these types was constructed like that of the Iowa species we have described, but we are strongly inclined to believe such was

[Dec.]

really the case, and that the apparent central opening was closed by vault pieces when the specimen was entire.

Of the American species presenting, so far as known, the characters of this genus as properly restricted, the following examples may be mentioned, though the vault of only the first two of these species is yet known to us, viz., *C. malvaceus*, Hall, *C. Iowensis*, Owen and Shumard, *C. (Poteriocrinus) Barrinii*, *C. viminalis*, *C. lamellosus*, *C. divaricatus* and *C. rotundatus*, Hall; also *C. Saffordi* and perhaps *C. Furleyi*, M. and W., and *C. rigidus*, White.

New species.

CYATHOCRINITES FRAGILIS, M. and W.

Body subsphæroidal, a little oblique, rather regularly rounded to the column below, from near the middle, and a little contracted above; composed of remarkably thin plates. Facet for the attachment of the column not excavated and very small. Base having the form of a very shallow, subpentagonal basin; basal pieces with a general subquadrangular form, but really pentagonal, from the slight truncation of their smaller inner ends at their connection with the column. Subradial pieces comparatively large, hexagonal, excepting the one on the anal side, which is larger than the others and heptagonal in outline. First radial pieces rather smaller than the largest subradials, somewhat wider than high, with a general subpentagonal form; all strongly incurved above between the free radials; facet for the reception of the second radials about one-third the breadth of the first radials and rather deeply excavated. Anal piece rather smaller than the first radials, longer than wide, irregularly hexagonal and supporting the outer side of the ventral tube (proboscis), which, like the body, is composed of very thin plates. Second (first free) radials very small, short and not always extending entirely across the excavation for their reception; succeeding radials, excepting the last, quadrangular, as viewed on the outside, about twice as wide as long, and abruptly rounded or subangular on the outside; last one pentagonal and generally a little longer than the others. Of these free radials four may be counted in one of the posterior rays, six in the other, three in one of the lateral rays, and seven in the anterior ray.

Arms at their origin on the last radials rather divergent, and in one of the posterior rays seen to bifurcate on the sixth piece, above which one of the divisions can be traced to the sixth piece without farther bifurcation, though there are probably other divisions beyond; arm pieces about as long as wide, and, like those of the free radials, all deeper than wide, and profoundly grooved within for the reception of the ambulacral organs. Surface smooth or only very finely granular.

Height of body, 0.50 inch: greatest breadth of same, about 0.75 inch.

This species is related to *C. rotundatus*, Hall, but not only differs in having its free radial series much stouter (judging from the facets for their reception in the typical specimen of that species now before us), but in having all of its body plates very decidedly thinner, while its first radials also differ in curving strongly inward, between the bases of the free rays. It likewise comes from the lower division of the Burlington beds, while the *rotundatus* came from the upper, and it has been found that scarcely any of the species are common to those two horizons.

Locality and position.—Burlington, Iowa; lower part of Burlington limestone. Mr. Wachsmuth's collection.

CYATHOCRINITES TENUIDACTYLUS, M. and W.

Body, exclusive of the free rays, deeply cup-shaped, rounded below, composed of moderately thick plates for a true *Cyathocrinus*. Column comparatively rather stout, composed near the base of alternately thin and somewhat thicker pieces, the latter of which project a little and seem to show a slight tendency to become minutely nodular; central canal distinctly pentapetalous in the form of its cross section. Base unknown (being accidentally shoved 1868.]

into the body with the end of the column in the specimen studied). Subradials of moderate size, those seen hexagonal. First radials somewhat larger than the subradials, a little wider than long, with a general subpentagonal form; facet for the reception of the second radials about one-third as wide as the upper side of the plate and excavated about one-third of the way down. Second radial pieces very small, wider than long, and with the succeeding radials curving outward. Third radial in one of the rays nearly as long as wide, expanded above and contracted below, and in this ray surmounted by a fourth, which, like the third in each of the only two other rays seen, is a triangular axillary piece, on which the arms rest, the upper angle being acute and so produced as entirely to separate the arm-bases, while the lateral slopes, on which the arms rest, are distinctly concave. Anal piece unknown.

Arms distinctly divergent at their origin on the last radials, as well as at their succeeding bifurcations, dividing on the third piece in two of the rays seen, and on the fourth in another, the pieces being rounded, nearly as wide as long, somewhat constricted in the middle and a little dilated at their upper ends, while all of the axillary pieces at the various bifurcations have much the same form as the last free radials. Beyond the first bifurcations mentioned, above the last free radials, several of the arms are seen to bifurcate again on the fifth piece and twice to three times more at various distances above, while they all gradually decrease in thickness with each bifurcation until they become much attenuated, though the pieces of which they are composed maintain their length to such a degree that those of the smaller divisions are nearly twice as long as wide.

Surface of body plates slightly beveled at the sutures and more or less roughened by small ridges or nodes, which on the subradial pieces present the appearance of nearly continuous, radiating, somewhat nodulous ridges, while those of the first radials have more the character of irregularly disposed nodes.

Length of body below the top of first radial pieces, 0.40 inch; breadth of same about 0.64 inch; length of arms from their origin on the last radials at least 2 inches and perhaps a little more.

This species seems to be more nearly allied to specimens in Mr. Wachsmuth's collection that have been identified with *Poteriocrinus Barrisi*, Hall, than to any other form with which we are acquainted. It differs entirely, however, in its sculpturing, that species having its body plates marked with numerous, rather fine, thread-like, radiating costæ. The arms, however, are more similar to those of our species, though they are rather stouter below in the latter.

We have not had an opportunity to see the type of *Poteriocrinus Barrisi*, but the form in Mr. Wachsmuth's collection, referred to that species by all the Burlington Geologists, is a true *Cyathocrinus*, or more properly *Cyathocrinites*.

Locality and position.—Lower division of the Burlington beds (Lower Carboniferous) at Burlington, Iowa. Mr. Wachsmuth's collection.

Genus BARYCRINUS, Wachsmuth, MS.

(*βαρύς*, heavy; *κρίνον*, a lily; in allusion to the ponderous nature of the plates and arms.)

Amongst the various American Carboniferous species that have been referred by different authors to the genus *Cyathocrinus*, there is a group of species which, although agreeing with that genus almost exactly in the number and arrangement of the pieces composing the body below the top of the first radials, that still differs in several rather strongly-marked characters. In the first place, these species are all more robust,* and have distinctly thicker and more ponderous plates and arms than in the typical forms of *Cyathocrinus*. They also differ in generally having a more or less developed, quadrangular subanal

* Some of them attain the gigantic size of more than 3.25 inches in breadth of body.

piece, inserted obliquely under one side of the first radial of the right posterior ray, and connecting with the only other anal piece above by a short oblique truncation of its right lower margin. This subanal piece varies in its proportional size, even in different individuals of the same species, and is sometimes very small, or even occasionally wanting, while it is very rarely, if ever, large enough to separate the first radial and the true anal piece above entirely from each other. A more constant difference, however, is the uniform presence of but two of the free primary radial pieces to each ray (instead of an irregular number), excepting perhaps sometimes in the anterior ray, where there may be one or two more. These free radials are also proportionally wider and shorter than in the typical forms of *Cyathocrinus*, particularly the second radial, which is often so short and wide as to present a nearly transversely linear appearance, as seen on the outer side.

As in *Cyathocrinus*, the species of this group have their arms and all their divisions composed each of a single series of pieces, apparently without pinnulæ; but here these pieces are always very much stouter, distinctly rounded, and only provided with comparatively very small, or almost linear ambulacral furrows. Again, they present marked differences in their method of division. That is, instead of regularly dichotomizing, so as to form equal divisions more or less frequently subdividing in the same way, the subdivisions regularly diminishing in thickness, they are often simple from their origin on the last radials, and merely give off along their inner lateral margins, at regular intervals, alternately on opposite sides, stout, rounded, simple armlets. In some instances one arm of each lateral ray, and sometimes one of each posterior ray, dichotomizes once or oftener, but even in these cases the other arms remain simple, and, like the principal branches of those that bifurcate, merely throw off alternately, at regular intervals along their inner lateral margins, stout armlets. If these armlets in this group performed the same offices as pinnulæ in other Crinoids, as we have every reason to believe the ultimate subdivisions of the arms in *Cyathocrinus* proper did, the sacks for the reception of the ova must have protruded considerably beyond the edges of the merely linear ambulacral furrows.

In the column of *Barycrinus* we also observe some more or less defined differences from that of *Cyathocrinus*. For instance, in the former group it is proportionally stouter, with a much larger canal, which is also rarely, if ever, perfectly round, but apparently always obtusely subpentagonal. But the most remarkable difference consists in its being often divisible longitudinally into five sections in *Barycrinus*. This character is not *always* well marked, being apparently sometimes obliterated by the sutures becoming anchylosed. In some cases, however, it is so strongly defined that we find the column with these sutures more or less separated along its entire length, and in some species there were apparently pores passing through these sutures to the cavity within. We are aware that several other types of Crinoids had the column in this way divisible into five parts longitudinally, but we have not seen any indications of it in the typical forms of the genus *Cyathocrinus*.

In regard to the vault of this group nothing is known, not a single individual of the numerous specimens belonging to various species hitherto found, showing, so far as we are aware, any traces of it. From this very fact, however, it seems probable that its vault differed from that of *Cyathocrinus* proper in being merely a soft ventral disc, without any covering of calcareous plates. If it had possessed the power of secreting vault pieces, it seems probable, from the thick ponderous nature of all its other parts, that these would have been sufficiently firm to have been found in place, in some of the numerous specimens now known. In addition to this, the upper inner edges of the first radial pieces, on each side of the free radials, are beveled off to an obtuse edge, and show no facets for the attachment of vault pieces.

Whatever may be thought in regard to this group being entitled to rank as a distinct genus, or as a subgenus, from *Cyathocrinus*, we can only say that the 1868.]

various species of the two groups can be as readily separated, even without specimens showing the arms, as those of any other two allied genera. Indeed, they can be far more readily separated than *Scaphiocrinus* and *Zeacrinus*, or than the former can in all cases be separated from *Poteriocrinus*.

Believing that a systematic classification of the *Crinoidea* really requires the separation of the group under consideration from the types for which the name *Cyathocrinus* was originally proposed, we cheerfully adopt for it Mr. Wachsmuth's appropriate manuscript name, *Barycrinus*. Mr. Wachsmuth refers to this group the following species, the first of which he regards as the typical form,—viz.: *B. spurius*, *B. crassibrachiatus*, *B. bullatus*, *B. tumidus*, *B. magister*, *B. Hoveyi*, *B. latus*, *B. Lyoni*, *B. sculptilis*, *B. Thomæ* and *B. protuberans*, all described by Prof. Hall under the name *Cyathocrinus*; also *B. cornutus* (= *Cyathocrinus cornutus*, Owen and Shumard).

We likewise place in this group our *B. Wachsmuthi*, *B. angulatus* and *B. sub-tumidus*, all of which were originally described by us under the name *Cyathocrinus*. It is possible our *Cyathocrinus? Sangamonens* may belong here, as it has the same thick body plates, as well as the small quadrangular intercalated subanal piece. Still, as all its first radial pieces are evenly truncated, their entire breadth straight across above, and provided with a transverse furrow, as if for the articulation of the second radials, it is probable these and the succeeding radials and arms (which are unknown) had a different structure and arrangement. It is certainly not a true *Cyathocrinus*, however, as properly restricted, but more probably belongs to an undescribed genus.

BARYCRINUS MAGNIFICUS, M. and W.

Body attaining a gigantic size, cup-shaped, or widening rather rapidly, with moderately convex sides from the column to the top of the first radials. Base shallow, basin-shaped, or about four and a half times as wide as high, with a large concave facet for the attachment of the column, and a large, obscurely five-lobed perforation for the connection of the central cavity of the column with the visceral cavity of the body. Basal pieces regularly pentagonal. Subradial plates about five or six times as large as the basal pieces, as wide as long or slightly wider, all regularly hexagonal, excepting one on the anal side, which is a little shorter than the others, and truncated above for the reception of the anal piece, so as to present a general heptagonal outline. First radial pieces about one-third wider than high, and larger (particularly wider) than the subradials, each presenting a general pentagonal outline, and provided with a rather shallow, outward sloping, concave facet, occupying more than one-third its entire breadth, for the reception of the succeeding radials. Second radial pieces very much smaller than the first, extremely short, or only about one-fourth as long in the middle as wide, and becoming much thinner, or wedge-shaped, on each side. Third radials a little longer in proportion to their breadth than the second, and presenting a subtrigonal outline, supporting on their sloping upper sides, broad, short, rounded arm-pieces. Anal piece about half as wide, and nearly of the same length as the first radials, and subquadrangular in form. Surface marked with small pustules, which often become confluent, so as to produce a peculiar corrugated roughness, somewhat similar to the ornamentation we see on the body plates of the true *Amphoracrinus*, but coarser.

Breadth of body 3.33 inches; height of do., 2.20 inches; breadth of base, 0.60 inch; breadth of facet for the reception of the column, 0.85 inch; do. of largest first radial piece, 1.70 inches; height of same, 1.30 inches. Thickness of one of the arms at base, 0.70 inch.

This splendid Crinoid was found by Mr. Green, of the Illinois Survey, with its plates detached and lying near together in the rather soft matrix. After working out the pieces, we succeeded in building up the entire body to the third radials and first arm-pieces, inclusive, excepting the anal piece, which was not found. It presents a very striking appearance, and is the largest Cri-

[Dea.

noid we have ever seen. If its arms were as long in proportion as those of some other species of this group, they must have been near twelve inches in length, and with its column, body and arms together, it may have been more than four feet in height. It is evidently related to *Barycrinus magister*, Hall (sp.), but differs from that species, the type of which is now before us, in having its surface roughened by numerous small pustules, showing a tendency to run together into vermicular markings, with an obscure effort, on some of the plates, to assume a radiating arrangement. It is true, the typical specimen of *B. magister* consists of only the basal pieces and a portion of the column, but these basal plates show no traces of the peculiar surface markings seen even on the base of our species, while we have before us, from the same original locality, another specimen of that species, consisting of the whole body, in a flattened and crushed condition, and, although the surface of its plates is well-preserved, they show no indications whatever of the surface markings seen on our species.

Those who give a wide latitude to genera will probably not regard such forms as this as being generically distinct from *Cyathocrinus*; even if that view should ultimately prevail, however, we should insist upon their separation as a strongly marked subgenus, and continue to write the name of our species *Cyathocrinites (Barycrinus) magnificus*.

Locality and position.—Henderson county, near Biggsville, Illinois; from the Keokuk group of the Lower Carboniferous.

BARYCRINUS HOVEYI, var. HERCULEUS.

Amongst other Crinoids from Crawfordsville, Indiana, we have before us several very large, fine specimens, agreeing well with Prof. Hall's description of his *Cyathocrinus Hoveyi* (Bost. Jour. Nat. Hist. vol. vii, p. 293), excepting in some important points in the structure of the arms. We suspect that these specimens are specifically distinct, but as neither any measurement, nor figures of the *C. Hoveyi*, have yet been published, we cannot feel quite sure of this, and therefore place them, provisionally, as a variety of the species *Hoveyi*, under the name *Herculeus*, which we propose to retain for the species if the differences to be noted are found to be constant, and of specific value.

The differences to which we allude are the following: In *C. Hoveyi* the arms of the antero-lateral rays are said to "have the anterior division twice bifurcating, above which the divisions give off branchlets, and the same feature marks the entire length of the lateral arm of the antero-lateral ray, which is smaller than the other." In the specimens before us, the anterior lateral rays have each the *posterior* division bifurcating *once* near the base, while the anterior division is *simple*, and *larger*, instead of smaller, than the other. Again, the *Hoveyi* is said to have, "in the postero-lateral arms, the lateral division of the rays bifurcating on the fourth piece, above which branchlets are thrown off, as in the others." In the specimens before us, however, *both* arms of the posterior rays are, like those of the anterior ray, and one of each lateral (or anterior lateral) rays, simple from their origin on the third radials, very long, stout, and give off along their inner lateral margins stout, simple armlets, alternately at regular intervals. As we have seen several specimens all agreeing in these characters, we are inclined to think this may be a specific difference.

In one of the specimens before us the body measures 1.10 inches from the base to the top of the first radials, and about 1.40 inches in breadth. The arms show a length of 4 inches, and are broken at the ends, so as to appear to have been, when entire, nearly one inch longer. They are very straight, nearly cylindrical, and measure 0.22 inch in diameter near the middle, where each arm-piece measures about 0.15 inch in length, and the lateral armlets nearly the same in diameter.

Genus NIPTEROCRINUS, Wachsmuth, MS.

(*νιπτειν*, a washing vessel; *κρίνον*, a lily; in allusion to its basin-shaped body.)

Mr. Wachsmuth has proposed the above name, in manuscript, for a type 1868.]

agreeing with *Cyathocrinus* proper in the thinness of its body plates, in the nature of the bifurcations of its arms, and apparently in the general structure of its body, excepting that it has no anal plate, the first radials being large, wide, and in contact all around, so as to leave no spaces for anal or interrarial pieces. The succeeding radials after the first are comparatively small, and number from three to four (so far as yet known) to each ray, the first always resting in rounded sinuses in the upper edge of the large first radials, much as in *Cyathocrinus*, excepting that these free radials are very short, more as we see in *Barycrinus*. They differ, however, from those of both *Cyathocrinus* and *Barycrinus*, in each having its lower edge along the outer side of the arms produced downward, into a corresponding sinus in the upper outer edge of each succeeding piece below, so as to present much the appearance seen in the arms of *Tazocrinus*, *Onychocrinus* and *Forbesiocrinus*, excepting that the produced part does not seem to be separate patelliform pieces, but merely the downward produced lower outer edge of each arm-piece itself.

None of the specimens yet found show the number of basal pieces, but we can see that its body is composed of small basals, with five well-developed subradials of uniform shape, and five large first radials. This structure of the body, it will be seen, is exactly that of *Erisocrinus*,—that is if the base is composed of five pieces, which is very probable. The whole structure and aspect of the parts above, however, is entirely different in these groups, since in *Erisocrinus* there are always but two primary radial pieces to each ray, while the second radials are as large as the first, and instead of merely resting in small sinuses in the upper part of the latter, the two articulate together by straight edges across their entire breadth, the articulating edges being always provided with a crenate transverse ridge and furrows. The arms of *Erisocrinus* are also much stouter, and present none of the characters of the type under consideration, while all of its body and arm pieces also differ in being very thick.

It is an interesting fact that the column of the genus here described, as well as its arms, present a striking similarity to that of *Tazocrinus* and allied groups, being round, and composed near the body of exceedingly thin pieces, connecting by crenate surfaces, and provided with a comparatively small central canal. Notwithstanding these points of resemblance, however, to *Tazocrinus*, it is evident that this group is more nearly allied to *Cyathocrinus*. If it has, as seems to be the case, five basal pieces, the formula of the genus would be as follows:

Basal pieces 5; subradials 5, all of the same form; radials 4 to 5 \times 5, the first being large and forming the larger part of the body, the others small and free; anals 0; interradians 0; arms bifurcating, and resembling those of *Tazocrinus*.

Some five or six specimens of this type show that the absence of anal pieces is not an abnormal, but a constant character.

NIPTEROCRINUS WACHSMUTHI, M. and W.

Body rather deeply basin-shaped, or a little more than twice as wide as high, rounding under from the top of the first radials to the column. Base small, flat, and nearly hidden by the column. Subradial pieces of moderate size, somewhat wider than long, and all pentagonal, there being no visible angle at the middle of the under side of any of them. First radials comparatively very large, or about three times the size of the subradials, twice as wide as high, and all alike pentagonal; while each is provided with a rather deep rounded sinus above, equaling about one-third of its breadth, for the reception of the succeeding radials, on each side of which its upper margin is nearly straight, horizontal, and not incurved. Second radials so short as scarcely to fill the sinus in the upper side of the first, and owing to the concave outline above, often presenting a narrow transversely crescentic form. Third and fourth radials (where there are five) very short, or several times as wide as long, and usually somewhat arcuate inversely. Last (fourth or fifth)

[Dec.

radials a little longer than the next below, and generally trigonal or subpentagonal (the upper angle being somewhat salient), and supporting the arms on its sloping sides. Arms rounded, rather divergent, and bifurcating on the sixth or seventh piece above their bases, and again once or oftener farther up, the divisions above each bifurcation being about half as large as the main arm below; arm-pieces about twice as wide as long, not wedge-shaped, but all showing the downward curvature quite distinctly, and slightly constricted on each side. Surface merely finely granular, and the plates of the body neither beveled nor tumid. Column composed of such thin pieces that about fifteen of them may be counted in a length equaling its own thickness, near the base.

Height of body of the largest specimen to top of first radials, about 0.43 inch; breadth near 1 inch.

Thickness of column of same, near base, 0.20 inch; diameter of its subpentagonal canal, 0.05 inch.

This Crinoid is so unlike all others known to us, that it is scarcely necessary to compare it with any of the described forms. The specific name is given in honor of Mr. Charles Wachsmuth, the author of the genus, to whom we are indebted for the loan of the typical specimens.

Locality and position.—Upper Burlington beds of the Lower Carboniferous. Burlington, Iowa.

Mr. Wachsmuth's collection.

Genus CATILLOCRINUS, Troost.

CATILLOCRINUS BRADLEYI, M. and W.

Body small, basin-shaped or rather broadly truncated below for connection with the column, and moderately expanding upward to the top of the radials supporting the arms. Lower series of plates visible around the top of the column, anchylosed together, and presenting the form of a broad low dish, many times wider than high, with the margins sinuous above for the reception of the next range of pieces. Succeeding range of plates presenting the usual irregular form of the genus, two of them being much larger than the others, very wide at the top, and supporting nearly or quite all of the arms; between these on one side there is a much smaller triangular piece on the same range, and extending up as high as the others, but so narrow at the top that it could not have supported more than one or two, if any, of the small arms. On the opposite side there are two other small intercalated pieces, the smaller of which is triangular and scarcely extends up to the top of the cup, while the other is oblong, extends to the top of the cup, and supports either another somewhat smaller (anal?) piece above, or the base of an arm much larger than the others. Arms about 44, in contact at their bases, and all slender and composed of joints two or three times as long as wide. Surface smooth. Column comparatively very large (circular?), with a large round central canal, and composed near the base of rather thin pieces of uniform size.

Height of body, 0.18 inch; breadth at top, 0.24 inch; breadth of column at the base of the body, 0.13 inch.

This species will be at once distinguished from *C. Tennesseeæ* of Troost by its much smaller size, and smooth instead of coarsely granular plates. It is much more nearly allied to our *C. Wachsmuthi*, from the Burlington group, but its body is less expanded at the top, and it also differs in having a comparatively large anal? piece, or larger arm, between the others on one side. Named in honor of Prof. Frank H. Bradley, of Hanover College, late of the Illinois Geological Survey, who discovered the only specimen known.

Locality and position.—Crawfordsville, Indiana; Keokuk division of Lower Carboniferous series.

Genus DICHOCRINUS, Munster.

DICHOCRINUS EXPANSUS, M. and W.

Body expanding rather rapidly from the facet for the attachment of the col-
1868.]

umn, to the top of the base, and still more rapidly from there to the top of the first radials, so as to make the breadth at the latter point about twice the height. Base forming less than half the height of the body, somewhat basin-shaped, though narrow below, or ornamented with small irregular wart-like nodes, which show some tendency to form three or four vertical rows, or ridges on each basal piece. First radial pieces comparatively large, somewhat oblong in form, being longer than wide, with the widest end above, all convex along up the middle, and strongly beveled, or excavated along the sutures on each side,—while the surface of each is ornamented with small, irregular, wart-like nodes, similar to those on the base; these sometimes coalesce into irregular ridges, but are usually arranged in three rows, starting from the most prominent upper end of the plates, and radiating to the base; facet for the reception of the second radial pieces about one-third the breadth of the upper end of the plates, and somewhat excavated. Anal piece of much the same size, and general nodose appearance as the first radial on each side, but somewhat longer, and having an irregular hexagonal form. Second radial pieces small, about twice as wide as long, and more or less quadrangular in form. Third radials slightly larger than the second, with a pentagonal form, the upper sloping sides supporting the first division of the arms.

Arms rounded, composed at first of pieces about as long as wide, upon the second or third of which they bifurcate, the outer divisions remaining simple, and the inner ones bifurcating again on the second or third piece, the outer division, as before, remaining simple, and the inner bifurcating a third time on the second pieces, thus making in the posterior rays (the only ones seen) eight arms to each ray, or forty in the whole series, if other rays have the same number. All the simple arms are long, slender, rounded, and but slightly tapering; near their bases they are each composed of a single series of somewhat wedge-formed pieces, but gradually pass into a double series of minute interlocking pieces.

Breadth of body, 0.98 inch; height about 0.43 inch. Length of one of the simple arms, about 1.60 inches; thickness of same at base, 0.05 inch.

Associated with the specimen from which the foregoing description was drawn up, several other imperfect examples were found, differing more or less in form and in the arrangement of their ornamentation, which either indicate considerable variations in these characters, or the existence of several allied species. One of these has the first radial and anal plates more abruptly spreading, and proportionally wider than in the typical form, while its nodes are more coalescent, so as more generally to run into continuous ribs. On the base, for instance, each of the two plates has three somewhat nodulous vertical ridges, with intervening rows of the little nodes, while the three rows of nodes on the first radial and anal pieces often run together so as to form mere nodulous ridges. It is possible this would be found to be a distinct species, if we could examine a specimen showing the arms. If so, it may be called *D. stelliformis*, in allusion to the star-like appearance produced by its spreading first radial pieces, with their little ridges running outward and converging to the outer extremity of each.

In another individual the nodes and ridges are all nearly obsolete, excepting a few of the former, which are very prominent at the middle of the outer ends of the first radials; while another has a single prominent node near the small facet in each first radial, for the reception of the second, with a few irregularly scattering nodes on other parts, and slender, obscure, nodular ridges near the lateral margins. From the general appearance of these specimens, we are rather inclined to the opinion that they are all varieties of one variable species.

Locality and position.—Same as last.

Genus DORYCRINUS, Roemer.

In the second volume of the Reports of the Geological Survey of Illinois, we distinctly recognized the *Dorycrinus* group as forming a well-defined genus,

[Dec.

clearly separated from *Actinocrinus* (as properly restricted), to which genus they have generally been referred; but owing to the fact that at that time we had never seen either a specimen or a figure of an *Amphoracrinus* showing the arms, body, and parts connected with the opening of the vault, all preserved together, we were under a misapprehension in regard to the true characters of that group, and consequently placed *Dorycrinus* as a synonym under it. Recently, however, we have been so fortunate as to see in Mr. Wachsmuth's extensive collection beautiful specimens of both types, in a remarkably fine state of preservation, and from these we are satisfied that a systematic classification of the *Crinoidea* requires these two groups to be separated as distinct genera.

In the first place, it may be proper to remark that in both of these groups the structure of the body, so far as regards the number and arrangement of the pieces below the arm-bases, is almost exactly the same as in *Actinocrinus*.* The structure of the parts above, however, is very different. For instance, in *Dorycrinus* the opening of the vault is never at the end of a more or less prolonged tube, or so-called proboscis, nor even in the slightest degree proboscidi-form, but is merely a simple aperture penetrating a somewhat thickened protuberance, and nearly always situated and opening laterally. The vault in this group is generally provided with a more or less prominent spine over each ray, and a sixth one in the middle. Sometimes these are all, or in part, merely represented by nodes, or even in some instances nearly obsolete, while in others they are extravagantly developed. Again, *Dorycrinus* differs from both *Actinocrinus* and *Amphoracrinus* in having, so far as yet known, always *two arms springing directly from each arm-opening, and these arms always simple*. Our attention was first called to this by Mr. Wachsmuth, who is a very careful and accurate observer, and we found it to be so in all the specimens in his collection, while he assures us that this is the case in all the specimens found by the various collectors at Burlington, as well as all of those he has yet seen from other localities, with the arms attached. Hence in all of the species of this group described by Prof. Hall and others, where the number of arms has been given from merely counting the arm-openings,—and specimens of these have since been observed with the arms attached,—their number is found to be *just double that stated in the descriptions*. It is also worthy of note that in this group the body plates are either plane, more or less tumid, or tuberculiform, and never marked with proper radiating costæ, as we often see in *Actinocrinus*.

The following is a list of the described species belonging to this group, all of which are, so far as known, exclusively American types, and confined to the Lower Carboniferous, viz.: *Dorycrinus Mississippianus*, Roemer, and *D. Gouldi*, † *D. cornigerus*,* *D. divaricatus*,* *D. trinodus*, *D. quinquelobus*,* *D. symmetricus*,* *D. desideratus*, *D. unispinus*,* and *D. subaculeatus*, Hall (sp.), all of which were described by Prof. Hall under the name *Actinocrinus*. It likewise includes *D. Missouriensis** (= *Act. Missouriensis*, Shumard) and *D. unicornis** (= *Act. unicornis*, ‡ Owen and Shumard), as well as our *D. subturbinatus*,* originally described as an *Actinocrinus*.

It might at a first glance be supposed also to include *Actinocrinus corniculatus* and *A. brevis* of Hall, but these forms (which Mr. Wachsmuth's collections clearly show to be only varieties of one species) have but a *single arm* from each arm-opening (two to each ray), and these arms with the proportional stoutness, general structure, and broad pieces at their bases, of *Agaricocrinus*. Hence this species can only be regarded as a somewhat aberrant form of the latter genus.

To the genus *Dorycrinus* we also refer the following new species:

* *Dorycrinus*, however, differs from *Actinocrinus* in having the second radial pieces nearly always short and quadrangular, instead of hexagonal.

† Specimens of all the species marked with an asterisk have been found with the arms attached, and presenting the characters mentioned above. The arms of the others remain unknown.

‡ The proposed species *A. tricornis* and *A. pendens*, Hall, are believed to be only varieties of *U. O. and S.*

DORYCRINUS ROEMERI, M. and W.

Body somewhat urn-shaped, being obconical below the arms to the truncated base, and moderately prominent above, the vault forming rather more than one-third of the entire height; greatest breadth at the arm-bases. Base truncated and somewhat concave below, about twice as wide as high, slightly expanded and a little angular below, with broad, rather shallow notches at the sutures. First radial pieces about twice and a half as wide as high, two heptagonal and three hexagonal, each one swelling out so as to form a moderately prominent, rather obtuse, transversely elongated node. Second radials one-third to nearly one-half as long as the first, quadrangular, a little wider than long, and more or less tumid. Third radials rather larger than the second, wider than long, pentagonal, hexagonal and heptagonal; each one supporting on each of its superior sloping sides a pentagonal secondary radial, of rather smaller size, each of which in the posterior rays supports, in its turn, on each side above, one, or sometimes two, brachial pieces, making four arm-openings to each of these rays. This seems to be the case also in the right lateral ray, while one of the secondary radials, in the specimen studied, appears to be merely truncated, so as to support (perhaps abnormally) only one brachial piece, thus making only three arm-openings to this ray. The brachial and secondary radial pieces of the anterior ray are broken away in the specimen, but it is probable there were four arm-openings in this ray. If so, there would be nineteen arm-openings (probably normally twenty) in the entire series, and thirty-eight to forty arms, counting two to each opening.

First anal piece of the same size and form as the first radials, and, like them, swelling out into a transversely elongated node. Above this there are two heptagonal, and one apparently hexagonal, rather tumid pieces in the second range, and above the latter several other pieces extending up between the arm-bases, so as to connect with a series of pieces forming a thickened protuberance rising even slightly higher than the summit of the vault, and pierced by the anal opening, which is situated considerably above the horizon of the arm-bases, but still directed laterally. Interradial pieces three to each area, the first being about half as large as the subradials, heptagonal or octagonal, and supporting two somewhat elongated irregularly formed pieces that are scarcely convex, and connect, by their narrow upper ends, with vault pieces above. Vault somewhat rounded, with lateral spines very short, or merely having the form of rather prominent conical nodes; central piece somewhat tumid, but not even conical. Arms and column unknown.

Named in honor of Dr. F. Roemer, the founder of the genus *Dorycrinus*.

Height of body to top of vault, 1.40 inches; do. to top of anal protuberance, 1.45 inch; breadth at arm-bases, 1.30 inch; breadth of base, 6.55 inch.

This species is perhaps more nearly allied to *D. Missouriensis*, Shumard (sp.) than to any other yet known. It will be readily distinguished, however, by several well-marked characters. In the first place, its base is not thickened and expanded as in that species. Again, its vault is not so flattened on top, nor the spines, or tumid pieces over the rays, near so large. In the *Missouriensis* the latter character is so strongly marked as to place the widest part of the body above the arm-bases, which consequently have the appearance of being attached half-way down the sides of the body, while in the species under consideration the body is distinctly wider at the arm-base than above. Our species also has seven or eight arms more than Dr. Shumard's.

Those who prefer to view the *Dorycrinus* group as only a section of *Actinocrinus* will, we hope, at least write the name of this species *Actinocrinus (Dorycrinus) Roemeri*.

Locality and position.—Upper part of the Burlington beds, of the Lower Carboniferous series, at Burlington, Iowa. No. 127 of Mr. Wachsmuth's collection.

DORYCRINUS QUINQUELOBUS, var. INTERMEDIUS.

On comparing this form with the typical specimen of *D. quinquelobus* (= *Actinocrinus quinquelobus*, Hall, Supp. Iowa Geol. Report, vol. i, p. 15), we find that

[Dec.

it agrees very closely in the structure of its body, as well as in the number of arm-openings to each ray (that is, four to the anterior and each posterior ray, and two in each of the lateral rays), but at the same time it presents some other differences, that we suspect may be even of specific importance. In the first place it is larger and more robust, and has a proportionally smaller base, and rather distinctly tumid, instead of even body plates, while its interradial and anal spaces are not near so deeply excavated between the arm-bases as in the type of *quinquelobus*. Its third radial pieces also differ in form, being so narrow in all the rays as to let the secondary radials come in contact with the first interradial and the second range of anal pieces, instead of extending around so far laterally as to separate these pieces. Its vault is likewise more flattened on top.

In the typical specimen of *D. quinquelobus* the spines of the vault have all been accidentally removed, but in the form under consideration they seem to have been short and stout, though their entire length is not known, as they were apparently broken off during the life of the animal, since they each have the broken end somewhat rounded and indented in the middle. In size and general appearance it is more like *D. Mississippiensis* of Roemer, but it differs in having rather more tumid body plates, as well as in the number of the arm-openings, that species having four of these openings to each ray all around. It also has a more protuberant anal opening, and probably had much shorter vault spines. It therefore seems to be somewhat intermediate between the *D. Mississippiensis* and *D. quinquelobus*, but is probably distinct specifically from them both. As we have but a single specimen, however, of it, and the typical specimen of *D. quinquelobus* for comparison, we prefer to place it, for the present, as a variety of that species, under the name *intermedius*, and if it should hereafter be found that the differences we have pointed out are constant, it can take the name by which we have proposed to distinguish it as a variety, as a specific name.

Locality and position.—Upper part of the Burlington division of the Lower Carboniferous series, at Burlington, Iowa. No. 164 of Mr. Wachsmuth's collection.

Genus AMPHORACRINUS, Austin.

As already stated, this group agrees with *Actinocrinus* in the number and arrangement of the pieces composing the under side of the body, as well as in having the parts adjacent to the arm-bases forming five projecting lobes, distinctly separated from each other by the anal and interradial sinuses. It differs from them both, however, in the structure of the parts above, as well as in having the body generally more depressed, or even flat below, and the vault proportionally more ventricose; while its second radial pieces are more generally hexagonal than in *Dorycrinus*. From the latter it also differs in having the opening of the vault more or less probosciform,* and placed nearly half way between the middle and the anal side, instead of being a simple generally lateral aperture, penetrating laterally a merely thickened protuberance. The probosciform extension of its vault, however, is never so long and slender as we usually see in *Actinocrinus*, and also often differs in being crowned with small spines surrounding the very small terminal aperture, which seems always to open upward. As in *Dorycrinus*, the vault is generally more or less spiniferous, though the spines are differently arranged, and, as far as yet known, never so extravagantly developed as we sometimes see them in that

* In all the foreign specimens of the typical species of *Amphoracrinus* that we have seen, only the broken base of this short proboscis remains; and this also seems to have been the case with nearly all those from which the published figures which we have had an opportunity to examine, were drawn. Cumberland, however, has given a figure in his *Reliquiæ Conservatæ*, (pl. C.), apparently of the typical species *amphora*, with the short oblique proboscis well preserved. This will be seen to differ materially from the merely slightly protuberant thickening in which the opening in *Dorycrinus* is situated.

group. Some of the species are known to have one of the vault pieces over each ray more or less protuberant, and it may be the case that species existed in which those were developed into spines, somewhat as in *Dorycrinus*, though we are not aware that any such have yet been found. Near the middle of the vault there is also a large tumid piece, sometimes developed into a short spine, while around the anterior side of this, four or five similar pieces are semi-circularly arranged, which also often become well developed spines.

We have never seen any figures or specimens of the European typical species of *Amphoracrinus* showing the arms, but there are in Mr. Wachsmuth's collection several beautiful specimens, found at Burlington, agreeing exactly in all other characters (not merely specific) with the types of the genus, in which the arms are perfectly preserved. In these we observe marked differences, both from *Dorycrinus* and *Actinocrinus*. For instance, in *Amphoracrinus divergens* (= *Actinocrinus divergens*, Hall), the arms, although *bifurcating so often as to form altogether about fifty-three or more divisions*, they are each, as well as each of these divisions, composed of a double series of very short alternating pieces *all the way down, even below all the bifurcations to their very bases*, with the exception of one to two or three simple brachial pieces, at the origin of each main arm on the last primary or secondary radials.

The structure of the arms, it will be seen, is the same as in *Saccocrinus* (an otherwise different type), but widely different from what we see in *Actinocrinus*, in which the arms are always composed of a *single series of pieces below* such bifurcations as take place. It is also even more decidedly different from that of *Dorycrinus*, in which the arms not only never bifurcate in any of the species in which they are known, but are also arranged so that two of them spring directly from each arm-opening without imparting to the brachial piece on which they rest the usual form of an axillary piece.

In one species, however, (*Actinocrinus spinobrachiatus*, Hall), having apparently all the other characters of *Amphoracrinus*, the arms do not bifurcate after their origin on the axillary secondary radial pieces. It seems, therefore, probable that there are some species of this group with simple arms, and others that have them more or less frequently bifurcating. The probability is, however, that in *all* cases when they do bifurcate, that they are equally composed of a double series of small alternating pieces *below* the bifurcations as well as above, the same as in the species *divergens*. Whether we include such species as the *spinobrachiatus*, however, with merely *simple arms*, composed like the others of a double series of alternating pieces throughout their entire length, as a separate section of *Amphoracrinus*, or view them as forming a distinct group, they need not for a moment be confounded with *Dorycrinus*, from which they not only differ in form, surface markings, opening of the vault, &c., but also in never having two arms springing directly from each arm-opening.

In all the species of *Amphoracrinus* known to us, either foreign or American, it is also worthy of note that the surface of the body plates is never ornamented with proper radiating costæ, such as we often see in *Actinocrinus* and other allied types, nor yet smooth, or properly tuberculiform, as in *Dorycrinus*, but always presents a peculiar vermicular style of sculpturing or corrugation difficult to describe, but very characteristic and easily recognized again after being once observed.

To this group Mr. Wachsmuth has, in MS., correctly referred the following American species, viz: *Amphoracrinus divergens*, *A. planobasalis*, *A. spinobrachiatus*? and *A. inflatus*, described by Prof. Hall, under *Actinocrinus*; also *Actinocrinus quadrispinus*, White; all from the lower division of the Burlington beds.

AMPHORACRINUS DIVERGENS, Hall, (sp.)

Actinocrinus divergens, Hall, Supp. Iowa Report, p. 36, 1860.

This species was apparently described by Prof. Hall from imperfect specimens, showing only a few of the lower bifurcations of the arms, since he

[Dec.

thought it probably had only twenty-two arms, while perfect specimens in Mr. Wachsmuth's collection show that they continued bifurcating farther up, so as to make the whole number about fifty-three or more, as already stated in another place.

Amongst Mr. Wachsmuth's specimens there is one (No. 136) with arms, body, vault and proboscis all in a remarkably fine state of preservation, which appears to agree very closely with the *A. divergens* in most of its characters, and yet differs in several respects. It has very nearly the same number of ultimate divisions in the entire series of arms, though there are differences in the details of their mode of divisions, so that the number of arms in any one of the rays is different from what we see in the corresponding ray of *A. divergens*. In each of its posterior rays there are, as near as can be made out, thirteen to fifteen arms; in one of the lateral rays and the anterior one, each eight, and the other lateral one eleven or twelve. Its ventral tube (proboscis) is rather stout, about one inch in length, and crowned by some six or seven small unequal spines, subspirally arranged. At the anterior side of the base of the proboscis, and nearly at the centre of the vault, there is a large tumid piece, and on each side of this a spine about three-fourths of an inch in length, directed obliquely outward, upward and forward, and in front of these two other prominent or subspiniiform pieces. In the typical *A. divergens*, these two anterior lateral larger spines each *bifurcate*, while in the specimen under consideration they are *simple*. The usual vermicular markings of the body plates in the specimen are well defined, and on the upper anal and vault pieces, as well as on those composing the proboscis, and even on the spines, the whole surface of which is occupied by rather coarse granules. As in the other species of this group, the arms of which are known, they extend at their bases, first horizontally outward, or even a little downward, and then curve upward.

It is probable that this specimen, with simple instead of bifurcating vault spines, and somewhat differently divided arms, may be specifically distinct from the *A. divergens*. If so, we would propose to call it *Amphoracrinus multiramosus*.

Genus BATOCRINUS, Casseday.

From deference to the most generally prevalent opinions of palæontologists, we have elsewhere included *Batocrinus* as a subgenus under *Actinocrinus*, though we did so with a protest, stating that we were strongly inclined to view it as a distinct genus. Our recent study of Mr. Wachsmuth's extensive collections has still more decidedly impressed us with necessity for separating these groups generically.

As we have in other places stated the genus *Batocrinus* presents no essential difference from *Actinocrinus* in the number and arrangement of the pieces composing the walls of the body below the arms, nor in the vault and its elongated central or subcentral tube, though its second radial pieces generally differ in being proportionally shorter and quadrangular, instead of hexagonal or pentagonal. One of the most obvious differences, however, consists in the arrangement of the brachial pieces and adjacent parts, which in *Batocrinus* form a nearly or quite continuous series all around, instead of being grouped into five protuberant lobes, separated by more or less wide and deep interradial and anal sinuses. Again, in *Batocrinus* the arms never bifurcate as we often see in *Actinocrinus*, all the divisions of the rays taking place in the walls of the body below the brachial pieces; while the arms, (which in all cases yet known, with one exception, spring singly from each arm-opening), are generally much shorter in proportion to the length of the proboscis, which often projects from one-third to one-half its entire length, beyond the extreme ends of the arms. Another difference is to be observed in the surface of the body plates, these pieces never being sculptured or ornamented with radiating costæ, as is often seen in *Actinocrinus*, but merely even, more or less tumid, or tuberculiform. The vault pieces in *Batocrinus* are also generally tuberculiform, or

1868.]

sometimes produced into short spine-like projections, but even where they assume the character of spines they never have the regularity of arrangement, nor do they ever attain the length we often see in *Dorycrinus* and *Amphocrinus*. The species of *Batocrinus* also present a much greater diversity of form than we see in *Actinocrinus*, since we find amongst them every variety of shape, from globose to turbinate, biturbinate, pyriform, discoid, and even in some rare aberrant types apparently belonging here, a conical or stelliform outline.

The species of this genus may be variously grouped to facilitate their study into sections and subsections, based upon their differences of form, and other more or less marked peculiarities, but for the present we merely propose to give a general list of them, and to notice a few types that we have elsewhere included in this group, but which we are now rather inclined to think may yet be found to be entitled to more prominence than has generally been supposed. These are the forms for which the names *Alloprosallocrinus* (= *Cenocrinus* of Troost's list) and *Eretmocrinus*, Lyon and Casseday, were proposed.

The first of these we only know from specimens consisting of the body without the arms or other parts. Its most striking peculiarity, so far as yet known, consists in its remarkable conical form, the body being nearly or quite flat below the arm-bases, which are at first directed out horizontally and then curve up; while the vault, which forms the whole visceral cavity, is produced upward in a conical form, so as to pass rather gradually into the central or sub-central tube, or so-called proboscis. This mere peculiarity of form, however, might be of little importance in a group presenting such great differences in this respect, but we observe that the arm-bases in the specimens of this type we have seen, are usually stouter and composed of rather wide short pieces, more like those composing the arm-bases of *Agaricoocrinus*. From this fact we suspect that this type may present some marked differences in the nature of its arms from the typical *Batocrinus*.

The other group (*Eretmocrinus*) is mainly distinguished by a remarkable flattening of the upper part of the arms, by which they are made to present a very curious paddle-shaped or spatulate outline. In some instances this character is so strongly marked, that the breadth of the arms is not less than six times as great above as below the middle. Below, the arms are, as in other types, usually rounded and slender, but farther up the flattening commences, first, by a slight angularity along each side, with often crenate margins, and increases upward above the middle until they sometimes present a very extraordinary alate appearance. The flattened part, however, is always as distinctly composed of a double series of alternately arranged pieces as that below, and these pieces are not only extended laterally to give breadth to the arms, but have also often as much as twice the diameter, in the direction of the length of the arms, of those further down. The ambulacral furrows, however, do not increase in size with the breadth of the arms, but even seem to be smaller above than below. We have not seen tentacula attached along the flattened upper part of the arms, but they probably existed there, as we have observed minute indentations at the inner ends of the flattened pieces, apparently for their attachment. The pieces composing the flattened part of the arms are thicker at their inner ends and thin off to their outer extremities, with slight outward curve, so as often to make the dorsal side of the arms not merely flat, but even slightly concave.

If these were free Crinoids, we might suppose this flattening of the arms a natural provision to adapt them for use as swimming organs, as *Comatula* is known to employ its arms for that purpose; but the species presenting this character have the column as well developed as we see in any of the other types, and were evidently attached to one spot during life. It is not improbable, however, that this peculiarity of the arms may have been a provision for the protection of the ova in the tentacula (pinnulæ), for, when these broad flattened arms were folded together, they must have covered these delicate parts within as if by a coat of mail.

[Dec.

The species presenting the character of arms described above, agree so closely in other respects with the typical forms of *Batocrinus*, that it is perhaps not always possible to distinguish them from specimens with the arms removed, though they seem generally to have a smaller number of arms, which are also generally longer in proportion, and a rather more excentric ventral tube, or proboscis, which appears also to be more liable to be bent to one side, and is often more or less swollen in the middle and narrow below.

These two groups (*Alloprosallocrinus* and *Eretmocrinus*) should, we think, be at least separated subgenerically from the typical forms of *Batocrinus*, and may even be found to belong properly to distinct genera. We should certainly be disposed to view the *Eretmocrinus* group as a distinct genus, if it were not for the fact that the peculiarity observed in the structure of its arms is subject to considerable variation in the degree of its development in the different species, being not very strongly marked in some species, while we also observe some slight tendency to a similar flattening of the upper part of the arms in other types of the *Actinocrinidae*, such, for instance, as in some species of *Dorycrinus*, and other forms usually referred, in this country, to *Actinocrinus*.

Below we add a list of the species of *Batocrinus*, which, it is worthy of note, are entirely confined to America, and, so far as yet known, nearly, if not entirely, to the lower Carboniferous rocks. We give first the names of the species of true *Batocrinus*, and under separate divisions those of *Eretmocrinus* and *Alloprosallocrinus*. We cannot, however, be positively sure, in all cases, in regard to the separation of the species of the subgenus *Eretmocrinus* from those of true *Batocrinus*, where specimens showing the arms are unknown. It will also be seen that, even as restricted by the separation, subgenerically, of *Eretmocrinus* and *Alloprosallocrinus*, the species referred to *Batocrinus* are susceptible of division into two sections, that may be entitled to greater prominence than is apparent from the specimens yet known.

1. BATOCRINUS, Casseday.

Section (a).—Species with arm-openings directed outward. Arms from 20 to 26. *Batocrinus icosidactylus* and *B. irregularis*, Casseday, and *B. formosus*, *B. discoideus*, *B. papillatus*, *B. æqualis*, *B. doris*, *B. lepidus*, *B. turbinatus*, *B. inornatus*, *B. longirostris*, *B. calyculus*, *B. biturbinatus*, *B. similis*, *B. lagunculus*, *B. mundulus*, *B. clavigerus* and *B. planodiscus*, Hall (sp.), all of which were described by Prof. Hall under the name *Actinocrinus*. Also *B. Andrewsianus* and *B. subæqualis*, described by Prof. McChesney under *Actinocrinus*. Likewise our *B. pistillus*, *B. pistilliformis* and *B. quasillus*. Also *B. rotundatus* (= *Actinocrinus*, O. and S.), as well as *B. Christyi** and *B. Konincki*† described by Dr. Shumard under *Actinocrinus*.

Section (b).—Species with arm-openings directed upward, and arm bases usually more in groups than in Section (a). Arms, so far as known, 20.

B. Nashvillæ (= *Actinocr.*, Troost); also *B. laura* and *B. sinuosus* (= *Actinocrinus*, Hall), *B. æquibrachiatus* (= *Actinocrinus*, McChesney), and our *B. asteriscus* and *B. trochiscus*.

2. Subgenus ERETMOCRINUS, Lyon and Casseday.

Species with arms flattened and alate above, and generally numbering from 12 to 20. Proboscis or ventral tube excentric, usually slender below, and sometimes swollen in the middle, and more or less bent to one side. Vault usually depressed. Brachial pieces more or less in groups, separated by inter-radial and anal sinuses.

Batocrinus (Eretmocrinus) magnificus, Lyon and Casseday, and *B. (Eretmocr.)*

* This is the only species of the whole *Batocrinus* group known to have two arms springing from each arm-opening, and this does not arise from a proper bifurcation, as the two arms rest directly upon the brachial pieces, without imparting to them the character of axillary pieces.

† This species has its arms slightly flattened, but not expanded above, showing a gradation towards *Eretmocrinus*.

calyculoides, *B. (Eretmocr.) remibrachiatus*,* *B. (Eretmocr.) clio*, *B. (Eretmocr.) matuta* and *B. (Eretmocr.) clælia*, Hall (sp.), all described under *Actinocrinus* by Prof. Hall. Also *B. (Eretmocr.) Vernueilianus*,† Shumard (sp.), described under *Actinocrinus*.

In all of the above species the arms have been seen, and are known to possess the characters of *Eretmocrinus*. The following species are believed to belong here from the general appearance of the body vault, proboscis, etc., though their arms have not yet been seen. They all certainly belong to *Batoerinus*, even if not to the group *Eretmocrinus*, viz.: *B. corbulus*, *B. carica*, *B. oblatius*, *B. sinuosus* and *B. gemmiformis*, all described by Prof. Hall under *Actinocrinus*. Also *B. urnæformis* and *B. Hageri*, described by Prof. McChesney under *Actinocrinus*. Also our *B. dodecadactylus*.

3. Subgenus *ALLOPROSALLOCRINUS*, Casseday and Lyon (= *Conocrinus* of Troost's lists).

Body distinctly conical, being flat below the arm-bases (which are directed outward on a plane with the flattened under side), and produced upward to the central proboscis so as to bring the whole visceral cavity above the arm-bases. Branchial pieces stout.

B. (Allopros.) conicus, *B. (Allopros.) depressus*, Lyon and Casseday, described under *Alloprosallocrinus*. Also our *B. (Allopros.) euconus*.

New Species.

BATOERINUS QUASILLUS, M. and W.

Body rather depressed, wider than high, nearly as prominent above as below the arm-bases; sides spreading very rapidly from the top of the first radials to the brachial pieces, which are in close contact all around, so as entirely to isolate the anal and interrarial pieces from the vault. Base comparatively rather broad, being nearly three times as wide as high, truncated and rather deeply excavated below, so as to overhang the end of the column; somewhat spreading below, with broad shallow notches at the sutures. First radials nearly twice as wide as high, two heptagonal and three hexagonal, and, like all of the other body plates (excepting the second radials), moderately tumid. Second radials generally very short, and sometimes, in part, merely transversely linear, or even entirely obsolete, all quadrangular, and flat on the outer side. Third radials small, generally pentagonal, and in all but the two posterior rays supporting on each of its superior sloping sides one, or sometimes two, secondary radials, the last of which (where there are more than one) is an axillary piece, and bears, in direct succession on each of its superior sloping sides, two brachial pieces, thus making four arms to each of these rays. In each of the posterior rays, however, there are two other bifurcations, that make six arm-openings to each of these rays, or twenty-four to the entire series. First anal plate of much the same size and form as the first radials, and supporting, in an arching series above, three smaller pieces in the second range, while above the latter, one, or perhaps sometimes two smaller pieces connect with the brachials above. First interradians about two-thirds as large as the first radials, and each supporting a smaller piece extending up to the brachials above. Vault composed of tumid, or sometimes rather obtusely pointed pieces, and provided with a subcentral proboscis, which is usually about as broad below as the base.

Height of the largest specimen to top of vault, about 0.70 inch; greatest breadth (which is at the arm-bases), 0.80 inch; breadth of base, 0.35 inch.

This species seems to be related to our *B. pistillus*, but may be easily dis-

* Prof. Hall mentioned, in describing this species, that it has the characters of *Eretmocrinus*.

† This species has the arms less distinctly alate than the others, the transition from *Batoerinus* to *Eretmocrinus* being through this and the species *Koninski*.

tinguished by its much more depressed form, particularly below the arm-openings, caused by its much shorter basals, and first and second radial pieces. Its base also differs in being much more excavated, and not near so expanded below, while its brachial pieces are proportionally stouter, and more crowded. Although the whole number of arm-openings is the same in these two forms, this arrangement is different, the formula of *B. pistillus* being $\frac{4}{5-5} = 24$, and that of the form under consideration $\frac{4}{5-4} = 24$.

Locality and position.—Lower division of Burlington beds of Lower Carboniferous at Burlington, Iowa. No. 14 of Mr. Wachsmuth's collection.

BATOCRINUS CASSEDAYANUS, M. and W.

Body rather broad subtrubinate below, or with the vault subglobose, being a little larger below than above the arm-bases. Base short, or about four times as wide as high, a little thickened, and slightly overhanging the end of the column, and more or less notched at the sutures, so as to present a somewhat trilobate appearance. First radial pieces of moderate size, and, like all of the other body plates, rather distinctly tumid, wider than long, two hexagonal and three heptagonal. Second radials about half as large as the first, nearly twice as wide as high, normally quadrangular, but some of them occasionally with one or both of the superior lateral angles a little truncated, so as to present an irregular pentagonal or hexagonal outline. Third radials sometimes a little smaller, and in other rays a little larger, than the second; all pentagonal, and (excepting in the anterior and one of the anterior lateral rays of the typical specimen) each supporting on each of its superior sloping sides, in direct succession, two secondary radials, generally of near its own size, the upper ones of which are also axillary pieces, and bear on each of their superior sloping sides two brachial pieces in direct succession (the last of which is generally larger than the first), thus making four arms to each of these rays. In the anterior ray, however, the third radial merely bears on each side above, three brachial pieces in direct succession, and the same is also the case on one side of one of the anterior lateral rays, thus only giving origin to two arm-openings in the first, and three in the latter, making seventeen arm-openings to the entire series. First anal of the same size and form as the first radials, excepting that it is proportionally a little longer; above this there are three smaller pieces in the second range, three in the third, and two or three in the fourth. First interradians of the same size as the second anals, hexagonal or heptagonal in form, and supporting two smaller pieces in the third range, with two to three or four still smaller pieces above, the upper one of which, like that of the anal series, separates the brachial pieces a little, so as to form a small sinus between the arm bases belonging to each ray.

Vault slightly ventricose, composed of very irregular, unequal, merely tumid pieces, and provided with a rather stout, nearly central proboscis, which is inclined a little forward in the typical specimen.

The specific name is given in honor of Mr. S. A. Casseday, deceased, the author of the genus *Batocrinus*.

Height of body to arm-bases, 0.70 inch; do. to base of proboscis, 1.07 inch; greatest breadth (at arm-bases), 1.20 inch.

This species is perhaps most nearly allied to *B. longirostris*, Hall (sp.), and if we suppose the presence of only three arm-openings in one of its anterior lateral rays to be abnormal, which is almost certainly the case, it would present no difference in its arm-formula, nor any marked difference in the details of its structure, excepting in the proportional sizes of certain plates. This latter character, however, imparts a material difference to the whole form of the body,—a difference, indeed, that is so striking as to be apparent at a glance. For instance, in *B. longirostris* the first and second primary radials and first anal, as well as the first interradian pieces, are all proportionally so much

1868.]

larger (particularly longer) as to make the body below the arms always distinctly longer and proportionally narrower. Another marked difference consists in the convexity of the body plates, those of *longirostris* being only slightly and evenly convex, while in the form under consideration they are decidedly tumid, and sometimes even angular. The arm-bases of the *longirostris* are also more distinctly separated by sinuses, and less robust. In short, the characters mentioned in the species *longirostris* impart to it a peculiar and very characteristic neatness and symmetry of appearance not seen in the form here described.

In form and general appearance our species resembles specimens sometimes supposed to be a broader and more robust variety of *B. subaequalis*, McChesney (sp.), but in that there are four arms to each ray, and the brachial pieces are in close contact all around, while its body plates are not merely tumid, but decidedly tuberculiform and projecting.

Locality and position.—Lower Burlington beds of the Lower Carboniferous, at Burlington, Iowa. No. 13 of Mr. Wachsmuth's collection.

BATOCRINUS TROCHISCUS, M. and W.

Body broad discoidal or wheel-shaped, being very narrow at the base and widening gradually to the top of the first radials, thence spreading very rapidly to the brachial pieces, which are large and nearly in contact all around, or but slightly separated by small sinuses over the anal, interrarial and axillary spaces. Vault flat, or a little concave from the periphery about half-way in toward the middle, thence rising moderately to the subcentral proboscis; composed of unequal pieces, the larger of which are rather tumid and arranged in radiating rows coincident with the rays and their division below, while the smaller pieces between are depressed so as to form concavities between the larger.

Base narrow, truncated, but not spreading or provided with a distinct rim below, wider than high, and widening very gradually upward. First radial pieces about of the size of the basal, but proportionally longer, though they are generally wider than long, two of them heptagonal and three hexagonal. Second radial pieces comparatively very small, and all wider than long, or transversely oblong, being, as usual in this group, regularly quadrangular. Third radial pieces about twice as large as the second, wider than long, and all pentagonal, excepting those of the two posterior rays, one of which is hexagonal and one heptagonal, in the specimen from which the description is drawn up; each supporting on each of its superior sloping sides, in direct succession, two secondary radials nearly or quite as large as the third primary radials themselves, while each of the upper of these secondary radials is an axillary piece, supporting on each of its sloping sides, in direct succession, two large brachial pieces, thus making four arm-openings to each ray all around, or twenty in the entire series. First anal piece about of the size of the smaller first radials, longer than wide, and heptagonal in form; above this there are in the second range three smaller hexagonal pieces, and, arching over the latter, four in the fourth range, with a small wedge-formed piece succeeding the latter above, though it is scarcely large enough to separate the brachial pieces over the anal area. First interrarial pieces nearly as large as the first radials, and all irregularly nine-sided; above this there are two smaller pieces in the second range, two, or sometimes only one, in the third, and above this one or two succeeding each other in a direct line, the last one being usually narrow, and partly or entirely wedged in between the brachial pieces so as, in some cases, to separate them a little. Between the first divisions of each ray on the third radials there are usually one or two interaxillary pieces, the first resting upon two short sloping upper sides of the first secondary radials, and supporting the second, which sometimes separates the brachial pieces a little, while in other instances it is so narrow and short as to allow them to come in contact over it. (Arms and columa unknown.)

[Dec-

The surface seems to be nearly smooth, or finely granular, and the body plates are nearly even, excepting the secondary radials, which, with the brachial pieces, are sometimes a little tumid, so as to project slightly beyond the plane of the interrarial and interaxillary areas, which consequently have a somewhat sunken appearance.

Height of body to arm-openings, 1 inch; breadth, 2.10 inches.

This fine species seems to be most nearly related to *B. planodiscus*, Hall (sp.), from the Keokuk beds, with which it agrees nearly in form and general appearance. It differs very materially in structure, however, since the rays in that species bifurcate so as to make eight arm-openings to each ray, or forty to the whole series, being just double the number seen in our species. The *planodiscus* also appears to have the arm-openings directed outward, while the species under consideration belongs apparently to the section of this genus with these openings directed upward.

It is an interesting fact, to which our attention has been called by Mr. Wachsmuth, that not only this species, but several others only found in the very highest part of the Upper Burlington formation, are more nearly allied to species found in the Keokuk beds than to any forms in the Lower Burlington beds.

Locality and position.—Upper bed Burlington division of the Lower Carboniferous at Burlington, Iowa. No. 27 of Mr. Wachsmuth's collection.

BATOCRINUS (EETMOCRINUS?) NEGLECTUS.

Body small, inversely campanulate below the arms, and rather ventricose above; the sides expanding gradually from the base to the third radials, and thence curving out rapidly to the outer edges of the brachial pieces, which are slightly grouped, but nearly or quite in contact all around. Base about three times as wide as high, truncated and concave below, but not thickened or expanded. First radials comparatively large, generally wider than long, and, as usual, two heptagonal and three hexagonal; all like the other body plates convex, but not properly tumid. Second radials much smaller than the first, quadrangular and nearly twice as wide as long. Third radials as long as the second, or slightly larger, wider than long, and all normally pentagonal; each supporting on each of its superior sloping sides a secondary radial, which in its turn bears on each side above two brachial pieces in direct succession, thus making four arm-openings to each ray, or twenty to the entire series. In one specimen, however, agreeing exactly in other respects, the third radials in the anterior and one in the posterior rays is immediately succeeded by brachial pieces without any further bifurcations, so as to give origin to only two arms to each of these rays; but this is almost certainly an individual abnormal development.

First anal plate a little longer, but not otherwise differing from the first radials; above this there are three smaller pieces in the next range, and sometimes one or two still smaller ones in the third range. Interrarial pieces one to three in each space, the first being one-third to one-half as large as the first radials, seven to nine sided, and usually supporting one or two smaller pieces in the second range above.

Vault convex, and composed of very unequal, irregular, moderately convex plates, provided with a tube or proboscis of moderate thickness, and placed generally about half way between the middle and the anal side. (Column and arms unknown.)

Height to base of proboscis, about 0.58 inch; do. to arm-openings, 0.33 inch; breadth, 0.55 inch. The specimen presenting the irregularity mentioned in the arrangement of the arms, is proportionally wider than that from which the above measurements were taken.

This little species is apparently nearer *B. clio*, Hall, (sp.), than to any other yet described. Its base, however, is much less thickened and expanded than in that species, and its body plates more even and smoother; while its brachial

pieces are less prominent, so as to give its body a less spreading appearance. Judging from the description, the *B. laura*, Hall, (sp.), would seem to be somewhat like our species, but that form must be more depressed and proportionally wider, and is also said to have the arm-openings directed upward, which would even place it in a different section of the genus.

We place this species provisionally in the *Eretmoerinus* group, from its general appearance, as we have not seen any specimens showing the arms.

Locality and position. Lower division, Burlington group, of Lower Carboniferous, at Burlington, Iowa. No. 14 of Mr. Wachsmuth's collection.

Genus PENTREMITES, Say.

PENTREMITES (TROOSTOCRINUS?) WOODMANI, M. and W.

Body attaining a large size, pyramidal-subovate, as seen in a side view, being broad below, and produced and gradually narrowing upward; strongly pentagonal as seen from above and below, in consequence of the projecting and actually carinated character of the radial pieces. Base strong, from two and a half to three times as wide as high, trilobate in general outline below, and very broadly and profoundly excavated along the three sutures, (the excavations being continued out beyond the base into the lower ends of three of the radial pieces); two of them pentagonal and tricarinate, and one quadrangular and bicarinate, the carinae projecting considerably below the deeply sunken facet for the attachment of the column, so that when placed erect on a level surface the body stands upon these carinae, like a tripod upon its legs. Radial pieces long and narrow, or about three times as long as wide, and gradually tapering upward; all extremely prominent along the middle and sloping strongly inwards laterally, very sharply carinate below the pseudo-ambulacral areas. Summit openings very small and closely approximated. Interradials very small, or only about one-tenth as long as the radials. Pseudo-ambulacral areas remarkably narrow or sublinear, and deeply sunken, extending down rather more than half the entire length of the body, or about two-thirds the length of the radial pieces; pore pieces minute, slightly oblique, and numbering about 100 to each side of each area, the two rows of each area being separated by a deep mesial furrow, along which the inner ends of the pore pieces are minutely crenate, lanceolate and supplementary pore-pieces unknown. Surface marked with microscopic lines, as fine, regular, and crowded, as if made by an engraver's ruling machine.

Height, 2.25 inches; breadth, 1.64 inches. Breadth of base, 1.14 inches; height of do., 0.50 inch; depth of excavations along the sutures of base, 0.20 inch; breadth of do. from 0.45 to 0.56 inch. Length of pseudo-ambulacral areas, 1.45 inch; breadth of do., 0.08 inch.

This extraordinary form differs so widely from all other known species, as to render a comparison of its specific characters with any of those hitherto described entirely unnecessary. It seems to be related to a group of species characterized by a triangular base, and very narrow pseudo-ambulacral areas, for which Dr. Shumard has proposed the name *Troostocrinus*. Still it presents some rather strongly marked differences from that group, the species of which have the body narrow, fusiform, and more or less elongate and tapering below, with the triangular base merely flattened on each of the three sides. In our type however, the body is broadest below, while the base is comparatively very short and wide, and has the three spaces corresponding to the flattened sides of the typical species of *Troostocrinus* so very profoundly and broadly excavated, as to impart a very remarkable appearance to the lower part of the fossil. Should it be thought desirable to designate this type by a distinct subgeneric name, it might be called *Tricaloerinus*, in allusion to the three deep excavations of the base.

The specific name of this form is given in honor of Mr. H. T. Woodman, of Dubuque, Iowa, to whom we are indebted for the use of the only specimen we have seen.

Locality and position.—Salem, Indiana. Lower Carboniferous, Keokuk Group?

[Dec.

Genus AGELACRINITES, Vanuxem.

AGELACRINITES (LEPIDODISCUS) squamosus, M. and W.

Depressed discoidal; outline circular, or somewhat oval. Rays slender, long, and strongly curved as they radiate from the middle toward the periphery, around which they are each extended for some little distance; all sinistral excepting the right posterior one, which curves to the left, with its outer half extending around within that of the next one on the left, near which it terminates at the so-called ovarian protuberance; each composed of two zigzag rows of very small pieces, with some irregular ones apparently not belonging properly to either row. Disc composed of large, thin, irregular, strongly squamose or imbricating plates, the imbrication being inward from the periphery, that is, the inner edge of each plate laps upon the outer edge of the next within. Ovarian? pyramid situated near the left outer margin of the posterior interbrachial space, and closed by ten pieces, apparently imbricating laterally and forming a depressed cone, around the base of which there are numerous small, short, but comparatively wide imbricating disc plates. Surface minutely granular.

Greater diameter of an apparently distorted specimen, 1.70 inch.

The only specimen of this species we have seen is somewhat crushed and distorted, so that it is rather difficult to make out the exact details of the structure of the rays, though they are apparently not provided with *open* ambulacral furrows, the rows of minute plates on each side, apparently closing up and interlocking. There appear, however, to be pores arranged along them in a zigzag row between the pieces. The body plates around the margin are much wider than high, and strongly imbricating upward. No central opening is visible.

On comparing this species with *A. Kaskaskiensis*, Hall (the only other known Carboniferous species), the type of which is now before us, we find that our species differs in the important character of having its disc plates all very distinctly imbricating, while those of Prof. Hall's species show no tendency to imbricate, the whole surface of each being clearly exposed, their straight edges being merely joined together like those of a true crinoid. From Prof. Hall's description, it might also be supposed that this species differs in the number of its rays, as he described it as having six rays. A careful examination, however, of the typical specimen has clearly satisfied us that this is certainly not the case, as it has only five, the usual number, as represented in the figure. It is the incurved extremity of the dextral right posterior ray, that has been mistaken for a sixth ray. The specimen is somewhat crushed and distorted, but by carefully cleaning it and removing some adhering portions of the matrix, this ray can be traced straight out to the periphery, where it curves abruptly around and extends inward to near the middle of the posterior interbrachial space, where it terminates at a point near which was doubtless situated the so-called ovarian pyramid; though the specimen is too much crushed there to show the latter.

It is worthy of note that our species, although agreeing with most of these that have been referred to *Agelacrinites*,* in the imbricating character of its disc plates, as well as in the direction of the curvature of its rays, still differs from *A. Hamiltonensis*, of Vanuxem, the type of the genus in both of these characters. Vanuxem gives no description, but judging from his figure, (Geol. Report Third Dist. N. Y., p. 306) one would naturally sup-

* By some oversight, Prof. Pictet figures, on pl. xcix, fig. 25, of his valuable *Traité de Paléont.*, a true *Agelacrinites*, and probably one of the Cincinnati species, under the name *Hemicystites parasitica*, Hall, a very different fossil from the Niagara group. He also alludes to Vanuxem's *Agelacrinites Hamiltonensis* in the text as a Silurian species, but it is a Hamilton group (Devonian) fossil. Dujardin and Rupé (Hist. Nat. Echinos. pl. 5, fig. 8) copy Pictet's figure under the name *Agelacrinites parasitica*, as an illustration of *Agelacrinites*, saying *Hemicystites* ought not to be separated from *Agelacrinites*. The real *Hemicystites parasitica*, however, although related to *Agelacrinites*, differs in several important characters.

pose the disc plates of his species to have the usual imbricating arrangement. Prof. Hall, however, has recently described it in detail, (Twentieth Report Regents Univ. N. Y. on State Cab. Nat. Hist. p. 299, 1868), and distinctly states that its interbranchial or disc plates are not imbricating, as in other species. He also mentions the fact that this typical species differs from others in having its anterior and right anterior and posterior lateral rays sinistral, and its left anterior and posterior-lateral rays curved to the left, as shown in Vanuxem's figure. It therefore certainly seems to us doubtful whether species differing in two such important characters as these are strictly congeneric. If they are not, then a new generic name should be applied to our species, and the others agreeing with it in these characters; in which case we would propose to designate this group of species under the name *Lepidodiscus* (*Λεπίδος*, a scale, and *δίσκος*, a quoit). At least we should think they ought to be separated subgenerically.

Locality and position. Crawfordsville, Indiana. Keokuk beds of Lower Carboniferous.

ECHINOIDEA.

Genus OLIGOPORUS, Meek and Worthen.

OLIGOPORUS NOBILIS, M. and W.

Large, globose, composed of very thick plates. Ambulacra nearly flat, or slightly convex, and without proper furrows, narrow lanceolate in outline, or only about two-thirds as wide as the interambulacral areas; pore pieces comparatively small, wider than high, those of the two outer rows rather more irregular in size, and some of them a little larger than any of those of the two inner rows; pores two to each piece, forming four double rows, those of the two outer ranges of pieces being placed near their inner ends, and those of the inner ranges near their outer ends. Interambulacral areas comparatively large, moderately convex, and composed of five rows of large plates, all of which extend to the disc above, while the middle one ends within about 0.65 inch of the oral opening below. Vent and apical disc much as in *Melonites multipora*. Surface of all the plates, both ambulacral and interambulacral, ornamented with coarse granules, separated by spaces generally a little wider than their own breadth, with sometimes a few smaller ones between. Of these granules, about 40 to 60 may be counted on each of the larger interambulacral plates.

Height and breadth, about 3.75 inch; breadth of ambulacral spaces, 0.60 inch; do. of interambulacral areas, 1.06 inch. Height of largest interambulacral plates, 0.26 inch; breadth of do., 0.40 inch; thickness of do., 0.25 inch.

The only specimen of this fine species yet known to us is mainly a silicious cast of the interior. The connection of the plates, however, are so distinctly defined by sharply raised lines formed by the silicious matter deposited in the sutures between all of the pieces before they were dissolved, that the entire structure can be made out as well as if the plates themselves had been preserved. A few of the plates, however, or rather casts of their external surface, remain so as to show the surface granules as well as the thickness of the plates themselves.

The apical disc seems to be very similar, as already stated, to that of *Melonites multipora*,—the arrangement and comparative sizes, as well as form of the ocular and genital plates, being much the same. In two of the latter, five pores may be counted in each, while one other also shows obscure indications of five pores and the other two had four each, as near as can be made out from the little projecting points representing them in the cast. No satisfactory indications of pores, however, are to be seen in the ocular pieces.

Although the ambulacral areas are not properly furrowed, as in *O. Dana* and *Melonites multipora*, they are slightly depressed below the most convex cen-

[Dec.

tral region of the interambulacral areas. The depression, however, also includes the two marginal rows of each interambulacral series. There is likewise a faint narrow, almost linear, impression on the internal cast, extending from the apical disc about half way down the middle row of plates in each interambulacral field.

This form can be at once distinguished from *O. Danæ*, the only other known species of this type, by its proportionally much larger and less numerous interambulacral plates, of which there are only *five* instead of *eight or nine* rows to each area. Its ambulacral areas are also proportionally narrower, and, as already stated, differ in not being furrowed along each side, with a ridge along the middle.

As we have elsewhere suggested, the group *Oligoporus* seems to be exactly intermediate in its characters between *Melonites*, Owen and Norwood, and *Palæchinus*, (Sconler) McCoy. That is, it differs from *Palæchinus* in having *four* rows of ambulacral pieces and four double rows of pores, instead of *two* of each, as well as in having the ambulacral areas more or less sunken below the interambulacral fields. In the last character it agrees more nearly with *Melonites*, from which, however, it differs widely in having only *four* rows of ambulacral pieces and *four* double rows of pores instead of *ten* of each to each area. In the nature of its apical disc the species under consideration shows that in this type it agrees well in its general characters with *Melonites*. We also know, from a crushed specimen of *Oligoporus Danæ*, that the species of this group have the jaws very like those of *Melonites*. The question may therefore arise whether or not these differences in the *number* of pieces and pores of the ambulacra are of generic importance, and whether we ought not to regard them as only subgeneric and call our species *Melonites (Oligoporus) nobilis*. On the same grounds, however, we would have as good reason to regard both *Oligoporus* and *Melonites* as mere sections or subgenera of *Palæchinus*. We cannot, however, believe so important and constant a difference of less than generic value, no gradations being yet known in this character between *Oligoporus* and *Melonites* on the one hand, or between the former and *Palæchinus* on the other. It is true we yet only know one species of *Melonites*, but we now know two well marked species of *Oligoporus*, while there are eight or nine known distinct species of *Palæchinus*, all of which latter agree in having but two rows of ambulacral pieces to each area.

At the time we proposed the name *Oligoporus* we were not aware that Prof. Desor had designated a section (not a genus) of the family *Cidaridæ* by the name *Oligopores*. In case this should be regarded as a serious objection to our name *Oligoporus* we suggested, in the second volume of the Illinois Geological Reports, the name *Melonopsis* for this group instead; and if it should be adopted, the species here described would have to be called *Melonopsis nobilis*. The name *Oligopores*, however, from its different termination, we should think sufficiently distinct.

Locality and position.—Calhoun County, Illinois, from the Burlington division of the Lower Carboniferous series.

Description of Seven New Species of AMERICAN BIRDS from various localities, with a note on *Zonotrichia melanotis*.

BY GEO. N. LAWRENCE.

1. *DENDRÆCA CAPITALIS*.

Male. Front and crown of a deep rich reddish brown; back and smaller wing coverts yellowish olive-green, becoming more yellow on the rump; central tail feathers and the outer webs of the others dark olive-brown, edged the color of the back, the inner webs of all except the central tail feathers are yellow; the quill feathers and the larger wing coverts are blackish brown, the primaries and secondaries with margins the color of the back, the terti- 1868.]

aries and wing coverts edged with yellow; under lining of wings deep yellow; under plumage deep golden yellow, with conspicuous reddish brow stripes on the breast and sides; bill blackish brown, the under mandible paler below; feet light brown.

Second, third and fourth quills equal and longest, first intermediate between fourth and fifth.

Length $4\frac{1}{2}$ in.; wing $2\frac{1}{4}$; tail 2 1-16th; bill 7-16ths; tarsi $\frac{3}{4}$.

The female differs in wanting the brown cap, having in place of it a slight wash of that color, and in there being only a few faint stripes on the breast.

Habitat.—Barbadoes. Types in my collection, obtained by Mr. A. H. Alexander, of West Hoboken, N. J., who informed me that it is an abundant species and familiar in its habits.

Remarks. This beautiful species needs comparison only with *D. petechia*, and the bird from St. Thomas and St. Croix, referred to *D. ruficapilla*, Gm., by Prof. Baird, with a ?, see Rev. Am. Birds, pp. 199 and 201; it is smaller than either, and they do not agree in the wing formula; the present species appears to have a greater extent of yellow in the tail feathers.

It is the same species as a specimen spoken of by Prof. Baird (Rev. Am. Birds, p. 202) but not named, which was brought from Barbadoes in alcohol by Prof. Gill.

Apart from its smaller size, its clearly defined and deeply colored crown will distinguish it from all others.

2. TACHYPHONUS ATRICAPILLUS.

Front, entire crown and occiput black, sides of the head and the hind neck grayish-black; back and smaller wing coverts dark olive-green, the rump olive, tinged with ferruginous; tail brownish-black bordered with greenish-olive; middle and larger wing coverts black, with greenish olive margins; quills black, the primaries narrowly edged on the outer webs with greenish yellow, the secondaries with olive green; under wing coverts pale yellow; throat of a light brown intermixed with gray, and tinged with rufous; lower part of the neck and sides of the breast olive-green washed with ferruginous; breast and abdomen bright brownish ferruginous, becoming yellowish on the middle of the belly; under tail coverts black bordered with ferruginous; bill black, the under mandible whitish at base; tarsi and toes black.

Length (skin) 5 in.; wing $2\frac{1}{2}$; tail $2\frac{1}{4}$; bill $\frac{1}{2}$; tarsi $\frac{3}{4}$.

Habitat.—The Island of Trinidad.

Type in my collection; it was killed at Trinidad in the early part of the present year by Mr. A. H. Alexander, from whom I procured it. A person who accompanied him at the time, and was familiar with the birds of the Island, said it was a species he had never noticed before.

Remarks.—This does not resemble in plumage any other member of the genus, and I think is probably a male; the black crown and distinctly colored under plumage seem to preclude the probability of its being a female.

3. QUISCALUS FORTIROSTRIS.

Male. Black, with purplish steel blue lustre, uniform throughout the body, not changeable as in most other species; wings and tail greenish, bill and feet black.

Second quill longest, first between third and fourth; tail graduated, lateral feather one inch shorter than middle feathers; bill very strong, culmen regularly curved throughout, commissure sinuated.

Length 9 in.; wing $4\frac{1}{4}$; tail $4\frac{1}{4}$; bill from front 1 1-16th; height of bill at base 7-16ths; tarsi 1 3-16ths.

The female is smaller, and the plumage, instead of being bluish, has a brownish cast of color.

Length 8 in.; wing $3\frac{3}{4}$; tail $3\frac{1}{4}$; bill 15-16ths; tarsi 1 1-16ths.

[Dec.

Habitat.—Barbadoes. Types in my collection, obtained from Mr. A. H. Alexander, by whom they were killed on that Island.

Remarks.—This very distinct species comes nearest to *Q. lugubris*, Sw., in its dimensions, but is rather smaller; that species is more violaceous in lustre, with longer and stouter legs, also a longer, straighter and more feeble bill, with the commissure straight; the bill of the new species is comparatively large, at the base being wider and fully one-third higher than that of *Q. lugubris*.

4. *THAMNOPHILUS VIRGATUS*.

Entire head, hind neck and all of the under plumage, of a grayish fuliginous color, blacker on the head and grayer below, with a broad stripe of pale ochreous white down the centre of each feather; these are clearer or nearly white on the head, and duller on the abdomen; back, tail and exposed portion of the wings cinnamon red; the inner webs of the quill feathers liver brown; the under wing coverts and inner margins of quills pale cinnamon; under tail coverts pale rufous; upper mandible black, the under whitish horn color; tarsi and toes black, claws whitish.

Length about 6 in.; wing 3; tail $2\frac{1}{2}$; bill about $\frac{1}{2}$; tarsi 1.

Habitat.—New Granada, Turbo. Collected by Lt. Michler. Type in Mus. Acad. of Nat. Sciences, Philadelphia.

Remarks.—In distribution of colors this species much resembles *T. palliatus*, but it is smaller and differs notably in the white markings throughout, being longitudinal; the crown in *palliatus* is immaculate, on which in the present species the stripes are strongly defined; the red coloring is paler and duller than that of *T. palliatus*.

From analogy I judge it to be a male, as the female of *T. palliatus* has a rufous crown.

The bill is injured by shot, the end being deficient; at first I was puzzled to know where to place it, but feel confident it is assigned its true position.

Analytical table of the Species of *BARIDIUS* inhabiting the United States:

BY JOHN L. LE CONTE, M.D.

According to the form of the antennæ the species before me may be divided into three principal groups, of which the second contains all the strongly pubescent species. The first group is the most numerous, and may again be subdivided by the presence or absence of the apical constriction of the prothorax. We will thus have the following scheme of arrangement.

A. Antennæ thick; 2d and 3d joints of funiculus equal.

a. Body nearly glabrous. Thorax not constricted near the apex. Sp. 1—8.

b. Body nearly glabrous. Thorax constricted near the apex. Sp. 9—22.

c. Body densely pubescent; thorax constricted near the apex. Sp. 23—25.

B. Antennæ slender; 2d point of funiculus longer than the 3d. Sp. 26—28.

A—a.

Intervals of elytra coarsely and irregularly punctured. 1.

“ “ with single rows of usually well marked punctures. 3.

“ “ with very fine inconspicuous punctures. 4.

1. Color black. 2.

Color bronze-black; prothorax longer than wide, gradually narrowed from base, rounded near the apex; dorsal carina very indistinct; beak stout, curved, moderately long, punctured. Long. 4.5 mm. Middle States. 1. *subæneus*.

2. More shining; prothorax not longer than wide, very slightly narrowed from base, much rounded near the apex; dorsal carina not apparent; beak stout, short, curved, punctured. Long 4.5 mm. Kansas (one specimen).

2. *quadratus*.

Similar to the last in size, form and sculpture, but the dorsal carina of the prothorax is well marked. Long 4.5 mm. Texas, Illinois. (Two specimens) 3. *carinulatus* Lec.

Less shining; punctures of elytra smaller and closer; prothorax more equally rounded on the sides, not broader than long, without dorsal carina; beak moderately long, stout, curved, punctured. Long. 4.5 mm. Kansas. (2 specimens)..... 4. *transversus* Say.

3. Black bronzed, shining; prothorax not longer than wide, very slightly narrowed from the base, much rounded near the tip, dorsal carina not obvious. (Resembles *B. subæneus*, but differs by the more full thorax, rather stouter form, and less irregular interstitial punctures of the elytra.) Long. 4—4.5 mm. Middle and Southern States..... 5. *tumescens*.

Smaller, black bronzed, shining; prothorax not longer than wide, more obliquely narrowed at tip and less rounded, dorsal carina not obvious; elytral striæ less strongly punctured than in *B. tumescens*; intervals with rows of well marked or very fine punctures. Long. 3 mm..... 6. *confinis*.

Black bronzed, very shining, prothorax more sparsely punctured, slightly narrowed from the base, broadly and obliquely rounded near the tip; elytra more finely and less deeply striate, intervals wider, nearly smooth. Long. 2.5—3 mm. Louisiana..... 6. *aereus* Sch.

4. Bluish black, shining; prothorax not longer than wide, obliquely narrowed from the base, broadly rounded near the tip, punctures more distant than usual, dorsal carina not obvious; elytral striæ scarcely perceptibly punctured, interstices nearly smooth, or with rows of very small punctures. Long. 4.25—4.75 mm. Middle and Southern States; five specimens. (Differs from *B. aereus* in color and in form of prothorax.) 7. *interstitialis* Say.

Black, shining; body narrow, prothorax longer than wide, sides broadly rounded in front, disc strongly punctured, without dorsal carina; elytra with a feeble oblique impression near the base, striæ scarcely punctured; interstices with rows of very fine punctures. Long. 3.5 mm. California; two specimens; San Francisco..... 8. *macræ* Lec.

A—b.

(The beak is longer and more slender than in A—a, and the thorax is transversely impressed near the tip, at least on the sides.)

Prothorax at base nearly as wide as the elytra.

1.

Prothorax at base narrower than the elytra; black, shining, very coarsely sculptured, elytral intervals not wider than the striæ, and marked with single rows of deep punctures. Long. 5.5—6.5 mm. Illinois, Kansas, Arizona.

9. *striatus* Say.

1. Body nearly glabrous, color black,

“ “ color bright brown,

2.

Body rather robust and convex, brownish black, more pubescent than usual; prothorax wider than long, gradually narrowed from the base and feebly rounded on the sides; elytral intervals with rather confused rows of somewhat transverse punctures. Long. 4—5 mm. Kansas. (Resembles in appearance a *Centrinus*). 10. *farctus*.

Body robust, black, more pubescent than usual, prothorax wider than long, feebly narrowed from the base, sides much rounded in front almost straight behind, very densely and coarsely punctured, with a slender carina; elytral intervals wider than the striæ, densely and confusedly punctured. Long. 4 mm. California, 3 specimens. S. Diego..... 11. *densus* Lec.

2. Prothorax with distinct smooth dorsal line.

3.

“ without “ “ “

6.

3. Elytral intervals usually not wider than the striæ, with rows of very strongly marked punctures; body larger and wider.

4.

Elytral intervals wider than the striæ, with single rows of finer shallow punctures; body smaller and narrower.

5.

[Dec.

4. Prothorax gradually narrowed from the base, broadly rounded on the sides, more strongly towards the tip, coarsely punctured, the punctures more distant than the length of their diameters; (elytral intervals and striæ as in *B. striatus*; resembles *B. carinulatus*, but the prothorax is distinctly impressed on the sides near the tips,) Long. 6 mm. Kansas and Wisconsin. 12. *strenuus*.

Resembles the preceding in form and sculpture, but the punctures of the prothorax are larger and more distinctly umbilicated, and the sides more deeply constricted near the tip. Long. 5 mm. Penna., one specimen; Mr. Rathvon. 13. *umbilicatus*.

Somewhat narrower and more regularly oval, prothorax gradually but more strongly narrowed from the base, and more obliquely rounded near the tip, less coarsely but somewhat more densely punctured than in *B. strenuus*; elytra with the intervals wider than the striæ, with rather confused rows of fine but well marked punctures. Long. 6 mm. Wisconsin, 1 specimen.

14. *subovalis*.

5. Punctures of prothorax more distant than their diameter, sides scarcely narrowed from the base, more broadly rounded near the tip, dorsal line wide; elytral intervals wider than the striæ with rows of distant large shallow punctures. Body less convex than usual. Long. 3.5 mm. New Mexico, 1 specimen. 15. *distans*.

Prothorax more densely punctured, sides slightly narrowed from the base, more obliquely rounded near the tip and more distinctly constricted; elytra as in the preceding, but with a small white pubescent basal spot each side, and a few scattered white scale-like hairs. Long. 3—4 mm. Southern States, 3 specimens. 16. *nigrinus* Say.

6. Body oval or elongate. 7.

Body broadly ovate, black shining, prothorax wider than long, strongly but not densely punctured, with very feeble dorsal carina, sides narrowed from the base, strongly rounded in front, and deeply constricted near the tip; elytral intervals wider than the striæ, with rows of small but deep punctures. Long. 2.5—3 mm. Middle States, 4 specimens. 17. *ovatus*.

7. Body oval, black shining, prothorax not wider than long, strongly and densely punctured, without dorsal carina, sides narrowed and broadly rounded from the base, slightly constricted near the tip; elytral intervals broad, with rows of very fine but well marked punctures. Long. 2.5 mm. Middle States, 2 specimens. 18. *pusillus*.

Body elongate oval, black, less shining, prothorax longer than wide, more coarsely punctured, punctures less distant than the length of their diameters, without dorsal carina, sides converging from the base, rounded only near the apex, which is feebly constricted; elytral intervals a little wider than the striæ, with rows of well marked punctures, disc feebly impressed obliquely each side behind the shoulder. (Of the same form as *B. macer*, but otherwise quite distinct. It differs remarkably from all the others of this division by the 2d joint of the funiculus of the antennæ being somewhat longer than the 3d, though much less conspicuously than in the species of division B.) Long. 3—3.5. Illinois and Kansas, 5 specimens. 19. *angustus*.

Also slender in form, black, not very shining, prothorax punctured as in the preceding, with the sides not converging from the base, but parallel, and more strongly rounded in front, tip feebly constricted; elytral intervals wider than the striæ, with rows of well marked punctures. (Resembles *B. macer*, but the thorax is more full in form, more densely punctured, and is feebly constricted at the tip; the beak is also longer and more slender.) Long. 2.5 mm. California, 1 specimen. San Francisco. 20. *seriatus* Lec.

Somewhat less slender, bronzed black, shining, prothorax scarcely larger than wide, narrowed from the base and feebly rounded on the sides except 1868.]

near the tip, where it is more strongly rounded and slightly constricted disc, coarsely but more sparsely punctured than usual, punctures more distant than the length of their diameters; elytral striæ impunctured, intervals much wider than the striæ, with single rows of small punctures. Long. 3 mm. One specimen, Oregon..... 21. *sparvus*.

8. Body elongate, bright brown, very shining, prothorax rather sparsely punctured with a broad undefined smooth medial line; elytral uneven, with a transverse impression before the middle, an oblique one behind the humeri, and a very faint one behind the middle; striæ feebly punctured, intervals much wider than the striæ, with scarcely perceptible rows of very fine punctures. Long. 3 mm. Ohio and Illinois; (depredates on grape vine, producing the gall described by Mr. Walsh as *vitiscurvus*.).... 22. *Sesostria*.²

A—c.

The species contained in this group are of a slender form like some of those in b, and like them have an elongated moderately slender beak; the antennæ are not quite so stout, though the 2d joint of the funiculus is not conspicuously longer than the 3d. The body beneath is densely clothed with depressed ash colored hairs, and is equally densely pubescent above. The prothorax is constricted near the tip, and the disc is strongly and densely punctured with a slightly elevated dorsal line. The species of this group have the last tarsal joint more elongated than in the other species of the genus, and the claws closely approximated, and somewhat connate at base; the males are also distinguished by the last ventral segment being armed at tip with a small tooth. These differences, combined with those of appearance, produced by the dense covering of hair, would indicate the propriety of separating them as a distinct genus.

Prothorax feebly constricted near the tip.

" more strongly " " "

1.

2.

1. Small, pubescence less dense, prothorax longer than wide, feebly narrowed in front, slightly rounded on the sides, and feebly constricted near the tip, without basal glabrous spots. Long. 3 mm. Maryland, 1 spec..23. *plumbeus*.

Larger, pubescence very dense, prothorax very little longer than wide, gradually narrowed in front, slightly narrowed on the sides, and feebly constricted near the tip, with three basal glabrous black spots extending upon the scutellum and base of elytra. Long. 4.5 mm. Atlantic States, abundant..... 24. *trinitatus* Say.

2. Larger, pubescence dense, prothorax scarcely longer than wide, subtrapezoidal gradually narrowed from the base, sides nearly straight, suddenly rounded near the tip and more strongly constricted, coarsely and densely punctured, distinctly carinated, marked with basal spots as in the preceding. Long. 4.5—6 mm. California, also at Cape San Lucas, 3 spec.

25. *mucoreus* Lec.

B.

The species of this division have the beak longer and more slender than those of A, and the antennæ are much thinner, the 2d joint of the funiculus is much longer than the 3d, thus showing an approach to *Centrinus*, which these species resemble in their form; the body is nearly glabrous, and the prothorax is constricted near the tip.

The three species before me may be distinguished as follows:

Body black, somewhat shining, prothorax strongly punctured, without dorsal carina, gradually and strongly narrowed from the base, and rounded on the sides; elytral intervals with single rows of strongly marked punctures, humeri scarcely wider than the base of prothorax. Long. 3.5 mm. Kansas, one specimen..... 26. *nasutus*.

* Vide Herodotus, Euterpe, cap. 102.

Body black, shining, prothorax as in the preceding, elytra at humeri distinctly wider than base of prothorax, intervals with confused fine punctures. Long. 3.5—4.5 mm. Southern States, 4 specimens. (Rather stouter in form than the preceding, and resembling almost exactly *B. farcus*, but quite different by the antennæ and beak.)..... 27. *ibis*.

Body brown, shining, prothorax longer than in the preceding and less rounded on the sides, more densely punctured with a faint dorsal carina; elytra at humeri distinctly wider than base of prothorax, intervals with confused fine punctures. Long. 3.5 mm. Georgia and Illinois, 4 specimens.

28. *scolopax* Say.

Bibliography.

- B. carinulatus* Lec. Proc. Ac. Nat. Sc., Phila., 1858, 79.
B. transversus Say. Curc. 18; ed. Lec. i, 282.
B. aereus Sch. Curc. viii, 141.
B. interstitialis Say. Curc. 18 and 26; ed. Lec. i, 282, 295; Journ. Acad. N. S. Ph. iii, 314; ed. Lec. ii, 176; Sch. iii, 684; viii, 149. In well preserved specimens small scale-like hairs are perceived in the rows of punctures on the elytral intervals.
B. macer Lec. Rep. Pac. R. R. Expl. xi, MS. 58.
B. striatus Say. Curc. 17; ed. Lec. i, 281.
B. densus Lec. Proc. Ac. Nat. Sc., Phila., 1859, 79.
B. nigrinus Say. Curc. 31; ed. Lec. i, 295. Sch. Curc. iii, 691; viii, 154.
B. seriatus Lec. Rep. Pac. R. R. Expl. xi, MS., 58.
B. trinotatus Say. Curc. 7; ed. Lec. i, 280; *vestitus* Sch. Curc. iii, 718.
B. mucoreus Lec. Proc. Ac. Nat. Sc., Phila., 1858, 79.
B. scolopax Say. Curc. 26; ed. Lec. i, 295; Sch. Curc. iii. 699. I do not know for what reason Schönherr has referred this species to his first division; Boheman, in the description, mentions the antennæ as *minus crasse*, which in fact they are.

Species unknown to me.

- B. T-signum* Sch. Curc. viii, 154.
B. anthracinus Sch. Ibid, iii, 727. Seems to be near 28. *ibis* Lec.
B. confertus Sch. Curc. iii, 728.
B. californicus Motsch. Bull. Mosc. 1845, ii, 372.
B. pubescens Uhler, Proc. Ac. Nat. Sc., Phila., 7, 417 belongs to *Centrinus* and is *C. pistior* Sch. = *Balaninus pistior* Germ.

The GYRINIDÆ of America, north of Mexico.

BY JOHN L. LE CONTE.

Species of this family are found in every part of the United States and contiguous northern regions, usually in large colonies; from their whirling motion of the surface of the water they are popularly known as *whirligigs*, and, on account of the agreeable fragrant odor of some of the species, as *apple-bugs*.

There is a remarkable uniformity of appearance in the species of each genus, which renders their definition and recognition somewhat difficult; for this reason, notwithstanding the very curious structural characters displayed in their organization, which are detailed in all systematic works, they are not favorites with collectors, and many of our species have remained unnamed.

Three genera are represented in our fauna:

Last ventral segment depressed, rounded at tip:

Scutellum distinct: labrum transverse..... *Gyrinus*.

Scutellum invisible; labrum transverse..... *Dineutus*.

Last ventral segment elongated, conical:

Scutellum invisible; labrum prominent.... *Gyretes*.

1868.]

DINEUTUS McLeay.

CYCLINUS Kirby.

The species of this genus are of larger size than those of the other two, and of less convex form; the elytra are marked with nine very slightly impressed, sometimes almost invisible, striæ or furrows; the labrum is rounded in front and ciliated, the scutellum is invisible, and the mesosternum is sparsely but coarsely punctured in front.

In the males the front tarsi are moderately dilated, and clothed beneath with feathery papillæ densely arranged in transverse lines, forming an elongated narrow brush; in *D. sublineatus*, *emarginatus*, *serrulatus*, and probably in *carolinus*, the front thighs of the male are dilated near the knee, on the anterior margin, into a more or less developed tooth, varying somewhat in form, according to the individual degree of development, but always well marked; in *D. vittatus*, *discolor* and *assimilis*, the tooth is entirely wanting.

The hind margin of the elytra is not toothed, nor strongly serrate, in any of our species, which may be divided into two groups as follows:

A. Sutural angles of elytra rounded.

B. Sutural angles of elytra well defined, sometimes slightly prolonged.

A.

14.5—15.5 mm. Black or black-bronzed, very shining; elytra usually with a brighter bronzed vitta; striæ faint; sutural angle very much rounded; under surface dark chestnut-brown, middle and hind legs pale..... 1. *vittatus*.

15.5—16.5 mm. Dark olive above, not very shining; elytral striæ distinct; sutural angle moderately rounded; under surface black; middle and hind legs iridescent, with the tibiæ and tarsi brown..... 2. *sublineatus*.

9—12.5 mm. Black, or black-bronzed, not very shining; elytral striæ very faint; sutural angle very much rounded, apical margin flat; under surface dark brown or blackish, slightly bronzed; middle and hind legs, narrow margin and tip of abdomen paler, nearly testaceous..... 3. *emarginatus*.

10.5 mm. Black-bronzed, more shining; elytral striæ very faint; sutural angle less strongly rounded; apical margin narrowly reflexed; under surface brown; middle and hind legs, broad margin and tip of abdomen pale.

4. *carolinus* n. sp.

B.

a. Body brown or testaceous beneath, oval, narrowed in front; hind margins of elytra very feebly sinuate; sutural angle of ♂ not, of ♀ very feebly prolonged.

12.5 mm. Body broadly oval, narrowed in front; upper surface black, slightly bronzed, shining; lateral margin of elytra broadly flattened; apical edge very finely serrate..... 5. *serrulatus* n. sp.

11—12.5 mm. More convex and narrower, narrowed in front; upper surface black-bronzed, rarely black, shining; lateral margin of elytra less broadly flattened; apical edge entire..... 6. *discolor*.

b. Body beneath black, slightly bronzed; middle and hind feet, and frequently sides and tip of the abdomen, pale; elytra distinctly sinuated near the tip in the ♀, and sutural angle very prominent in that sex.

10.5—12 mm. Black, usually slightly bronzed, ♂ more shining than the ♀; middle and hind legs testaceous; margin and tip of abdomen pale; elytra feebly striate, sparsely and finely punctulate; (♂ with the elytra not sinuate near the tip, feebly sinuate at the tip; sutural angle slightly prominent; ♀ deeply sinuate on the side near the tip; margin elevated at the sinuosity, sinuate again at the tip, with the sutural angle very prominent.).. 7. *assimilis*.

[Dec.

Bibliography and remarks.

1. *D. vittatus* Aubé, Hydroc. 768; *Gyrinus vitt.* Germ. sp. nov. 32; *Cyclous opacus* Mels., Proc. Acad. Nat. Sci. Phila. ii, 29 (faded specimens). Middle and Southern States, not rare.
2. *D. sublineatus* Aubé, Hydroc. 775; *Gyrinus subl.* Chev., Col. Mex. cent. i; ♀ *D. integer* Lec, Proc. Acad. Nat. Sci. Phila. vii, 221. Arizona and Lower California.
3. *D. emarginatus* White, Brit. Mus. Cat.; *Gyrinus emarg.* Say, Trans. Am. Phil. Soc. ii, 108; ed. Lec. ii, 519; *D. americanus*† Aubé, Hydroc. 777 (nec. Linn.) Abundant in the middle and northern States; for remarks on *Gyrinus americanus* Linn., showing its probable identity with the West Indian *D. metallicus* Aubé, see the note of Dr. Schaum in Stettin Ent. Zeit. 1848, 337.
4. *D. carolinus*. I have seen but two ♀ specimens, collected in South Carolina; it closely resembles the preceding, but is more shining, and the apical margin of the elytra, instead of being flat, is very narrowly reflexed.
5. *D. serrulatus*. Middle and Southern States. I have seen but two ♂♀ specimens of this species, which resembles in form *D. assimilis*, but is easily distinguished by the fine serration of the apical margin of the elytra, the sutural angle less prominent, the lateral flattened margin broader and more reflexed, the posterior sinuosity of the elytra of the female much less, the striae of the elytra less visible, and finally by the front thighs of the male being armed with a strong sharp tooth.
6. *D. discolor* Aubé, Hydroc. 784; *Cyclous labratus* Mels. Proc. Acad. Nat. Sci. Phila. ii, 29. Abundant from Canada to Louisiana, and from Maine to Kansas; easily known by its narrower form and pale ferruginous under surface; the front thighs of the male are not toothed.
7. *D. assimilis* Aubé, Hydroc. 778. *Cyclinus ass.* Kirby, Fauna Bor. Am. iv, 78. *Gyrinus americanus* Say, Trans. Am. Philos. Soc. ii, 107; ed. Lec. ii, 519. Our most abundant species, usually known as *apple bug*; extends from Lake Superior to Texas, and from Maine to Kansas. The front femora of the male are not toothed.

GYRINUS Linn.

"The species of this genus, as at present defined, are peculiar in having 11 rows of punctures on each elytron, and an oval transverse figure limited by punctures near the tip. The legs are always ferruginous, or testaceous. Usually two frontal impressions and two thoracic transverse impressions are well defined, but they are not equally evident in every individual, and are sometimes entirely obliterated.

"For the better definition of the species it must be observed that in those in which the upper surface has a shining metallic gloss, the color becomes sometimes black, and sometimes in part dark brown; in the same proportion the black color of the breast and the abdomen varies to ferruginous. The obliteration of the rows of punctures next the suture is of doubtful specific value, as is also the size of the specimens, both of which characters are subject to great variations."—Zimmermann, MS. To this I may add that the frontal impressions are of no value in distinguishing species.

On account of the close resemblance between the species, it has been very difficult to identify them by the descriptions thus far published, and, as will be seen in the bibliography and remarks, the determinations are frequently different in each of the standard collections which have been independently formed in this country.

My own determinations are in some instances at variance with those of Dr. Zimmermann and Dr. Harris, and I hope may be sustained by reference to the types preserved in European collections; but at all events the possession of a much larger number of specimens, from more widely separated localities, has 1868.]

given me greater advantage in distinguishing and defining the forms to which specific names must, in the present condition of science, be given.

The species before me may be arranged in the following groups, the meso-sternum being of normal form in all except *pectoralis*:

A. Scutellum flat:

- a. Under side margin of prothorax and epipleuræ testaceous.
- b. Under side margin of prothorax and epipleuræ metallic black.

B. Scutellum finely but distinctly carinate:

(Under side margin of prothorax and epipleuræ testaceous.)

A—a.

* Under surface uniform testaceous, or brown.

6—6.75 mm. ♀. Elongate oval, polished black, more or less bronzed; punctures of the elytral rows approximate, rather fine; tip much rounded, outer angle not distinct..... 1. *confinis* Lec.

6 mm. ♀. A little less elongated, polished black, not bronzed; punctures of the elytral rows stronger, and equally closely placed. 2. *fraternus* Couper.

4.5—5 mm. Smaller, not very elongate, polished black; margins and sides broadly bronzed; punctures of outer elytral rows stronger and moderately approximate; abdomen sometimes dark at the middle..... 3. *limbatus* Sey.

5.5 mm. ♀. More elongated, uniformly black bronzed; punctures of elytral rows rather strong, moderately approximate..... 4. *aeneolus*, n. sp.

4.5—5 mm. Of the same form, color and sculpture as *limbatus*, scarcely bronzed and a little wider; the ventral segments of the abdomen in mature specimens are darker brown, the punctures of the elytral rows more approximate, with the last segment paler..... 5. *dichrous*, n. sp.

5.25 mm. ♂. More elongate, strongly attenuated before and behind, and more elevated at the middle than usual, black, highly polished, broadly bronzed on the sides, but not on the suture or reflexed margin of the elytra; rows composed of larger bronzed punctures not very approximate, becoming coarser at the sides; tip truncate, slightly rounded; outer angle not very obvious; body beneath and legs ferruginous. (Easily distinguished by its more compressed convex form and coarser punctures.)..... 6. *elevatus*, n. sp.

5.5—6.5 mm. Elongate oval, more narrowed in front, black, highly polished; margins and sides slightly bronzed; tip of elytra more concave than usual; (margin not interrupted); rows of elytral punctures bronzed, well marked, approximate; under surface uniform reddish-brown. (Resembles *confinis*, but is much larger and more narrowed in front, from the base of the elytra)..... 7. *consobrinus* Lec.

5—6.5 mm. Of the same form, color and sculpture as *consobrinus*, but a little broader and with the reflexed margin of the elytra interrupted near the tip by a small flattened space, and the tip less rounded..... 8. *plicifer* Lec.

6.5—7 mm. Oval, less elongate, black, very highly polished, iridescent; margins and sides bronzed; rows of punctures of elytra well marked, approximate; under surface reddish-brown, sides and tip of abdomen a little paler. (A beautiful species, easily known by its larger size and more brilliant iridescent surface; in one specimen the under surface is nearly black.)

9. *ventralis* Kirby.

6.5 mm. Similar in size, color and sculpture to *ventralis*, and equally brilliant, but somewhat narrower in form, with the tip of the elytra more suddenly truncate, less rounded and with the outer angle obtuse, only slightly rounded and quite distinct..... 10. *aquiris*, n. sp.

**Trunk dark piceous; abdomen with tip and lateral spots pale.

6—6.75 mm. More elongate than usual, black, highly polished, slightly iridescent; margins bronzed; punctures of elytral rows bronzed, fine, well marked, approximate; tip more rounded than usual..... 11. *maculiventris*, n. sp.

[Dec.

*** Trunk black bronzed, or piceous bronzed; tip of abdomen reddish-brown.

7.25—8 mm. Oval, less elongated, black, shining, but not polished, very minutely punctulate or rugose; margins bronzed; tips of elytra more concave than usual; punctures of rows well marked, approximate. (Easily distinguished by the fine punctuation of the upper surface and the bronzed color beneath.)..... 12. *affinis* Aubé.

A—b.

a. Body oval in form, regularly convex.

* Anterior margin of mesosternum regular in form.

5.25—5.75 mm. Oval, equally attenuated at each end, black, shining, highly polished; margins and sides bronzed; elytra with rows of deeply impressed, bronzed, coarse punctures, so approximated that the outer striae appear impressed; tip broadly subtruncate, feebly rounded; outer angle distinct.

13. *parvus* Say.

5.5—6.5 mm. Oval more elongate, nearly equally narrowed before and behind, black, shining, highly polished; margins and sides bronzed; elytral rows composed of approximate bronzed punctures, the outer ones a little stronger than the inner; tip of elytra strongly rounded, outer angle not distinct; last ventral segment sometimes dark reddish-brown; sides of prothorax slightly rounded.

a. Apical oval of punctured curve of elytra composed of large, coarse punctures.

β. Apical oval curve composed of very fine punctures, almost obliterated; middle and hind legs darker than usual..... 14. *picipes* Aubé.

5.25 mm. Smaller and a little narrower than *picipes*, of a less shining black, feebly bronzed, more brilliantly at the margins and sides; elytral rows composed of less approximate bronzed punctures, the outer ones a little stronger than the inner; tip of elytra strongly rounded; outer angle not distinct; apical oval curve composed of distant, well marked punctures; middle and hind legs darker than usual..... 15. *opacus* Sahlb.

7 mm. Larger and a little stouter, black, highly polished and with bluish reflections; margins and sides bronzed; elytral rows composed of fine bronzed, very closely approximated punctures, outer rows distinctly impressed; tip of elytra broadly truncate, feebly rounded; outer angle distinct, though obtuse and rounded; legs ferruginous, under surface black; last ventral segment very dark brown..... 16. *borealis* Aubé.

6 mm. Of the same form, color and sculpture as the preceding, but still more highly polished; the elytra are still less rounded at tip, and the punctures of the rows are less fine and less approximate, and the outer rows, though a little stronger, are not impressed; the under surface is black, the last ventral segment ferruginous in one, but very dark brown in two other specimens; the legs ferruginous..... 17. *pernitidus*, n. sp.

6—7 mm. Of the size and form as *borealis*, but above black, less highly polished and not at all bronzed; tip of elytra more rounded, with the outer angle less distinct; the rows are composed of small but less approximate punctures, and the outer rows, though stronger, are not impressed; the under surface is black, feebly bronzed; the legs ferruginous, and the last ventral segment dark brown..... 18. *lugens* Zim.

5—6 mm. Smaller, more elongate, black bronzed both above and beneath; upper surface not highly polished; elytra with the tip broadly but not strongly rounded; outer angle not distinct; rows composed of not very fine, less approximate punctures, outer rows but little stronger than the inner ones; legs and last ventral segment ferruginous. (Resembles in form, size and sculpture *G. opacus*, but is more bronzed above and beneath, the legs and last ventral segment are paler and the inferior pair of eyes are larger.... 19. *analis* Say.

1868.]

** Front margin of mesosternum trilobed, with an oblique impression each side.

5—6 mm. Oval, shining black, highly polished, margins and sides bronzed; elytra at tip moderately rounded; outer angle not distinct; rows composed of bronzed, approximate punctures, outer rows not stronger than the inner ones; beneath black, slightly bronzed; legs ferruginous, thighs darker. (Of the same size and form as *G. limbatu*s and *consobrinu*s, but easily recognized by the very peculiar form of the mesosternum.)..... 20. *pectoralis*, n. sp.

♂. Body broader, subovate, more suddenly convex at the middle and obliquely declivous before and behind.

5.5 mm. ♀. Uniform black, bronzed above; elytra with the tip broadly truncate, feebly rounded, outer angle distinct but rounded; rows composed of fine approximate punctures, outer ones not stronger, lateral margin more broadly reflexed than usual. Beneath black, with slightly metallic reflection, last ventral segment dark brown, legs ferruginous; mesosternum feebly channelled for its entire length..... 21. *gibber* Zim.

B.

4—4.5 mm. Elongate oval, bluish black, not highly polished, sides broadly bronzed; elytra with the tip truncate, feebly rounded, outer angle somewhat distinct, though rounded; rows composed of approximate bronzed punctures, the outer ones stronger than the inner; under surface, inflexed margins and legs ferruginous, anterior ventral segments sometimes darker; mesosternum with a very deep median furrow..... 22. *minutus* Linn.

3.5—4.5 mm. Of the same size and form as *minutus*, but a little narrower and more convex and of a more dull black color, though slightly bronzed at the sides; prothorax more rugose, rows of the elytra composed of more approximate punctures, and especially distinguished by the mesosternum being but feebly channelled in front, with a large elongate posterior fovea; under surface always ferruginous yellow.

23. *rockinghamensis* Zim.

Bibliography and Remarks.

1. *G. confinis*. Similar in form to the Californian *G. consobrinus*, but less polished, with a slight bronzed color over the whole upper surface, more brilliant at the suture and margins. Abundant at Lake Superior. I have also several specimens from the interior of Oregon or Montana.

2. *G. fraternus* Couper, Canadian Naturalist, 2d ser. ii, 60. Canada and Lake Superior; for types I am indebted to Mr. W. Couper, late of Quebec, but now of Ottawa. Is of the same size as the preceding, but a little more robust, and easily distinguished by the entire absence of bronzed lustre on the upper surface, even at the suture and margin.

3. *G. limbatu*s Say, Trans. Am. Phil. Soc. ii, 109; ed. Lec. ii, 520. Canada and Lake Superior. In one specimen the suture is not bronzed, and in one the abdomen is dark brown at the middle. I received from the late Dr. T. W. Harris a specimen of this species from Western New York, as No. 1642 of his collection, *G. analis* Say, and in Dr. Zimmermann's collection it is named *G. limbatu*s Say. From the former it differs by the under surface being ferruginous. It is quite possible that the determination of Dr. Zimmermann is correct, and although I have seen no specimens from Georgia and Florida, the locality mentioned by Say, I have no other which agrees so nearly with his description, or which resembles in appearance *G. analis*, with which he compares it.

4. *G. aeneolus*. One specimen, Illinois, Mr. Willcox. This species is easily known by the uniform and tolerably brilliant bronze color of the upper surface, which, with the more elongate form and ferruginous under surface perfectly defines it.

[Dec.

5. *G. dichrous*. New England. I received this species from Dr. Harris as bearing the name in the Melsheimer collection; specimens under the same name are contained in Dr. Zimmermann's cabinet, now in possession of Dr. Samuel Lewis. It closely resembles *G. limbatus*, but is a little more robust, and not bronzed on the margin and suture.

6. *G. elevatus*. One specimen, New York, No. 1829 Harris' collection. Very distinct by its more convex elevated body, more strongly attenuated at each end, and by the much coarser punctures of the outer elytral rows.

7. *G. consobrinus* Lec. Ann. Lyc. Nat. Hist. New York, v, 209. Abundant in California, at San Francisco, Mendocino, &c.

8. *G. plicifer* Lec., *ibid.* California, not abundant. Easily known by the reflexed edge of the elytra being interrupted near the tip by a slight depression, so that the appearance of a small fold is produced, extending from the small depression to the apical truncation. I received from Mr. A. Murray a smaller specimen, which agrees sufficiently with the description of *G. marginiventris* Motsch., Bull. Mosc. 1859, ii, 174, to induce me to place the latter as a synonym.

9. *G. ventralis* Kirby, Fauna Bor. Am., iv, 80; Aubé, Hydroc. 672. A common species from Pennsylvania, northward to Lake Superior; in the Zimmermann collection it is determined as *G. ventralis* Kirby, but although agreeing in other respects with Kirby's description it seems generally too large to be referred to the latter, which is compared with *G. aeneus*, a much smaller species. Specimens occur in which the under surface is chestnut brown, with the inflexed margins, the sides and tip of the abdomen and the legs paler ferruginous; *G. limbatus* † Aubé, 670 (nec Say), is considered by Dr. Zimmermann to belong to this species.

10. *G. aquiris*. Middle States; differs from the preceding in the narrower form, and more squarely truncate elytra; the under surface is darker brown, in one specimen nearly black, with the inflexed margins, sides and tip of abdomen, and feet paler ferruginous; it is less elongate than the next species and the pale color of the sides of the ventral segments is not arranged in spots but is diffused. On account of the more sudden truncation of the tips of the elytra I would refer *G. limbatus* † Aubé to this, rather than to the preceding species.

11. *G. maculiventris*. Abundant at Lake Superior; one specimen from Montana; more elongate than usual, and easily recognized by the dark brown color of the under surface, with well marked pale triangular spots each side on the ventral segments.

12. *G. affinis* Aubé, Hydroc. 669. New York to Lake Superior; I have also two specimens from Middle California. Our largest species, easily distinguished by the upper surface of both sexes, (not alone of the ♂ as mentioned by Mr. Aubé), being covered with very fine lines, producing under a high lens an aciculate appearance. I received from Dr. Harris one specimen as No. 819 var. *G. limbatus* Say, *teste* Say, but its much larger size, as well as the dark bronzed color of the greater part of the under surface, completely separate it from that species.

13. *G. parvus* Say, Trans. Am. Phil. Soc., iv, 448; ed. Lec. ii, 562; Aubé, Hydroc. 701. Two specimens from Texas agree with the descriptions of this species; they differ from the other small species having the under surface black bronzed, by the more coarse punctures of the elytral rows, the outer ones of which become, by the approximation of the punctures, slightly impressed.

14. *G. picipes* Aubé, Hydroc., 694; Mannh. Bull. Mosc. 1843, 223; *ibid.*, 1853, ii, 164. Alaska and Oregon. I have three specimens collected in Labrador, one of which does not seem to differ from the types from Alaska kindly sent me by Baron Chaudoir and Count Mnizech; in one of the specimens [1868.]

mens the inflexed margins are slightly tinged with dark reddish brown, as mentioned in the remarks of Mannerheim under the second reference. Two specimens (♂ ♀) from Labrador, are much smaller, only 5.25 mm. long, but do not seem to differ in any other respect; var. b, of the last reference, is probably a distinct species, but I have seen no specimen to correspond with it.

a. A race of this species is represented by four specimens from Lake Superior, which resemble in appearance the typical *G. picipes*, but differ only by the apical crescentic oval curve of the elytral being composed of larger punctures. This differs from the others of the same group (except *pernitidus*) by the more elongate form, more highly polished surface, and more brilliantly bronzed suture, margin and punctures; *G. pernitidus* is more highly polished, but has the elytral rows composed of less approximate punctures; *G. borealis* is larger and stouter than the two species in question, though otherwise resembling them very closely.

15. *G. opacus* *Sahlberg*, Ins. Fenn., 47; *Schödté*, Naturhist. Bidrag. Grönland, p. 54; *G. æneus* *Aubé*, Hydroc. 690, (sive *Redtenbacher*). Mr. Drewsen, of Copenhagen, has kindly sent me three specimens of this species, with a very complete series of the other Coleoptera of Greenland. *G. æneus* *Kirby*, Fauna. Bor. Am. iv, 80, must according to the size given (2 4-5th lin.) be a much larger species, which is unknown to me, unless it be *G. borealis*.

16. *G. borealis* *Aubé*, Hydroc. 692. New York to Lake Superior; the distinguishing characters of this have been sufficiently pointed out in the remarks upon other species.

17. *G. pernitidus*. The type of this species is a single ♀ from Georgia; with it I have associated two other females sent me by Dr. Harris, as No. 242, *analis* ? *Say*; one of the specimens agrees perfectly with the type, while in the other the punctures of the rows of the elytra are much less approximate, the inner rows less strongly marked, and the last ventral segment nearly black, instead of ferruginous, as in the type; it is probably a distinct species, and is perhaps a small specimen of *G. Sayi* *Aubé*, 698, which is otherwise unknown to me.

Dr. Zimmermann determined this as *G. borealis*, but the size given in the description of Mr. *Aubé* (7 mm.) represents a larger species, and I have accordingly referred it to the preceding.

18. *G. lugens* *Zimm.* MS. New England and Lake Superior; easily known by the larger and stouter form, similar to *G. borealis*, but not at all bronzed above.

19. *G. analis* *Say*, Trans. Am. Phil. Soc., ii, 108; ed. Lec. ii, 520; *ibid.* iv, 448, ed. Lec. ii, 562; *Aubé*, Hydroc. 697. Louisiana to Lake Superior, easily distinguished by the upper surface uniformly bronzed; the under surface black bronzed, with the last ventral segment and feet ferruginous; the form is narrower than in the other species of this group, except *G. opacus*, which is, however, less oval and more narrowed behind.

20. *G. pectoralis*. Lake Superior and Hudson Bay Territory, (Fort Liard).

21. *G. gibber* *Zimm.*, MS. I have seen but the single specimen of this peculiar species found in North Carolina by Dr. Zimmermann, from whose MS. I have translated the description; this unique specimen was kindly given to me by Dr. Samuel Lewis.

Bibliography and remarks.

22. *G. minutus* *Fabr.*, Syst. El. i, 276; *Kirby*, Fauna Bor. Am. iv, 81; *Aubé*, Hydroc. 683. Lake Superior, abundant. I have omitted much of the European synonymy of this species, as not applicable to our fauna; it is, however, necessary to observe that the fine carina of the scutellum which distinguishes this and the next, so far as I know, from all others of the genus

[Dec.

is not mentioned by the authors above cited, nor by Redtenbacher; but attention is called to it in the description of Thomson, Skandiv. Coleoptera, ii, 117.

23. *G. rockinghamensis* Zimm., MS. Dr. Zimmermann mentions in his MS. that he found this species in schools of several thousands, in ponds at Rockingham, North Carolina. I have translated the description from his notes.

Species not identified.

G. impressicollis Kirby, Fauna Bor. Am. iv, 79. Mr. Adam White, B. M. Cat. 45, refers this to *G. borealis* Aubé, but the great size, unless an error of print, (4 lines, = 8.3 mm.) renders such reference very improbable. *G. Sayi* Aubé Hydroc. 698. See remarks under No. 17.

G. fuscipes Motsch. Bull. Mosc. 1859, ii, 173. California; perhaps *G. consobrinus* Lec.*

GYRETES Brullé.

1. *G. sinuatus*, elongate oval, very convex, dark bronzed, very shining; sides of prothorax and elytra densely punctured and pubescent, punctures reaching the suture; tip of elytra broadly and obliquely truncate, outline of the truncation very slightly but distinctly sinuate, outer angle distinct, slightly prominent, inflexed margins ferruginous; body beneath and legs ferruginous, breast and base of abdomen darker. Long. 6 mm. Lec. Ann. Lyc. Nat. Hist., New York, v, 210.

Abundant in the Colorado River, near Fort Yuma, California.

2. *G. compressus*, still more elongate, and more convex than the preceding, and more narrowed in front than behind, dark bronzed, shining; sides of prothorax and elytra densely punctured and pubescent, punctures not quite reaching the suture; tip broadly and obliquely truncate and very feebly sinuate, outer angle obtuse, distinct, slightly prominent, inflexed margins black; body beneath dark brownish red, feet and tip of abdomen paler. Long. 6.75 mm. Lec., New Spec., North Am. Col., (Smith's Inst.) 23.

One specimen collected at Quincy, Illinois, by Mr. Willcox.

Notes on the Species of AGONODERUS, BRADYCELLUS and STENOLOPHUS inhabiting America north of Mexico.

BY JOHN L. LE CONTE, M. D.

The final demolition of the genus *Acupalpus* Dej. seems to have been accomplished by Baron Chaudoir, in his recent notes upon North American Carabidæ,† by the reference of most of the species contained in my third division of *Stenolophus*‡ to *Agonoderus*. In fact, his suggestion is so perfectly natural, that it is strange that the resemblance in form and sculpture, and in the proportion of the joints of the hind tarsi, with the absence of sexual characters in the front tarsi, did not long since cause these species to be placed in the proper position to which he has assigned them.

In reviewing the specimens of my collection with the aid of the remarks of my learned friend, I have found such resemblances in form between the species

* Mr. Uhler has sent me a portion of a large school of *Gyrinus*, collected in Charles River, near Cambridge, Mass., which shows that in some cases at least the species do not live apart. An examination of all the individuals captured has given me the following results:—

| | |
|------------------------------|------------------------------------|
| <i>G. limbatus</i> , 4♂, 5♀. | <i>G. fraternus</i> , 2♂, 2♀. |
| <i>G. dichrous</i> , 5♂ 6♀. | <i>G. picipes</i> ? (race), 5♂ 3♀. |
| <i>G. confinis</i> , 12♂ 7♀. | <i>G. lugens</i> , 18♂ 4♀. |

I have observed at Lake Superior, however, that the species are generally not found intermixed.

† Revue et Mag. de Zoologie, 1868.

‡ Vide List of Coleoptera, North Am., p. 13.

of the three genera above named, that a brief synopsis of the distinguishing characters of those which I have investigated seems to me to be useful for the proper naming of the specimens contained in local cabinets.

I may also add that the determinations of Baron Chaudoir, who is the fortunate possessor of the Dejeanian types, must be taken as conclusive, regarding the species of that author; the original descriptions were unfortunately defective in some respects, and my recognition of his species was therefore erroneous.

In all the species mentioned in this synopsis, except *Bradycellus dichrous*, *vulpeculus* and *autumnalis*, the marginal line limiting the bead of the prothorax is obliterated for a greater or less extent at the middle of the base, but in those three species it is entire, as in the true *Harpali*, with which, perhaps, they should more properly be associated.

AGONODERUS Dej.

In the species of this genus the emargination of the mentum is less semicircular in outline than in *Stenolophus*, but equally destitute of any vestige of a tooth; the sides of the emargination are more oblique and the bottom therefore narrower, like a broadly rounded angle; the body is rather stouter and more convex, the joints of the antennæ thicker, the hind tibiæ and tarsi less slender, the joints 1—4 of the latter diminishing in length less rapidly, the front tibiæ stouter and more strongly spinose near the tip, and finally the front tarsi are alike in form in both sexes and in the more slender species thinly clothed with a few papillæ.

Our species, all but one of which, as far as known, are represented in my collection, diminish gradually in size, and may be grouped as follows, the dorsal puncture being wanting only in *A. infuscatus*:

A. Body stouter and more convex: prothorax transverse, quadrate-oval.

a. Hind angles of prothorax very much rounded.

7—8.5 mm. Pale yellow above; prothorax with two discoidal spots; scutellar stria long; elytra with two dark stripes separated by the sutural interval; dorsal puncture distinct..... 1. *lineola*.

6.5 mm. Dark testaceous or piceous, narrow margin of prothorax and broader one of elytra pale; scutellar stria shorter; dorsal puncture wanting..... 2. *infuscatus*.

b. Prothorax nearly quadrate; hind angles obtuse, slightly rounded; sides less rounded.

8 mm. Pale yellow; head behind the eyes black, with an occipital round yellow spot; prothorax with two discoidal oval black spots; base finely and not densely punctured; elytra with two dark stripes, as in *lineola*; scutellar stria long. (Differs from *lineola* chiefly by the form of the prothorax.) California, and Nevada..... 3. *maculatus*, n. sp.

B. Body more elongate, less convex; prothorax scarcely wider than long; subtrapezoidal, being more or less distinctly narrowed behind; elytra with one dorsal puncture.

a. Larger species; color pale; elytra with a wide black stripe, divided by the suture; disc of prothorax frequently with a large black spot; head always black.

5.5—6 mm. Hind angles of prothorax rounded; scutellar stria long.

4. *commata*.

5.5—7 mm. Hind angles of prothorax scarcely rounded; scutellar stria short..... 5. *pallipes*.

7 mm. Sides of prothorax subsinuate behind; hind angles rounded; scutellar stria short? (interrupted in the only specimen I have seen); hind tarsi stouter than in *pallipes*. California..... 6. *rugicollis*.

[Dec.

b. Smaller species.

* Head black; scutellar stria distinct.

3.5—4 mm. Prothorax pale; hind angles much rounded; basal impressions with a few coarse punctures; elytra with a broad, dusky stripe or cloud, divided by the sutural interval; body dusky beneath..... 7. *partarius*.

3—3.25 mm. Very similar to *partarius*, but smaller, with the basal impressions less marked, and still more sparsely punctured; elytra dusky, with the suture and margins pale; prothorax pale above and beneath; trunk always and abdomen usually dusky..... 8. *pauperculus*.

3—4 mm. Equal in size to *partarius*, but narrower, with the sides of the prothorax not rounded behind, but even feebly subsinuate; the hind angles are, however, rounded, the disc marked with a large, quadrate, blackish spot; elytra blackish, with the suture and margin testaceous; scutellar stria longer than in *partarius*..... 9. *indistinctus*.

** Head pale, of the same color as the prothorax; body testaceous or ferruginous beneath, not blackish; scutellar stria short or wanting.

2.5—3 mm. Prothorax with the hind angles much rounded; basal impressions faint, marked with a few large punctures; elytra with the scutellar stria punctiform; disc sometimes with a faint dusky cloud..... 10. *testaceus*.

2.75 mm. Of the same size and form as the preceding, with the scutellar stria distinct though short, not punctiform..... 11. *micros*.

Bibliography and remarks.

1. *A. lineola* Dej., Sp. Gen., iv, 51; *Carabus lineola* Fabr., Ent. Syst., i, 155; Syst. El., i, 197; Oliv., 35, 78, pl. 7, f. 75; *Feronia lineola* Say, Tr. Am. Phil. Soc., ii, 37; ed. Lec., ii, 464; *Carabus furcatus* Fabr., Ent. Syst., i, 164; Syst. El., i, 206, (var. thorace immac.)

Carabus comma Fabr. cannot be referred to this species, as is erroneously stated in the Melsheimer Catalogue and thence copied into my List, since it is described as having the head black.

2. *A. infuscatus* Dej., Sp. Gen., iv, 54; *suturalis* Lec., Ann. Lyc. New York, iv, 373.

4. *A. comma*. *Carabus comma* Fabr., Ent. Syst., i, 165; Syst. El., i, 207; *Feronia pallipes* Say, Trans. Am. Phil. Soc., ii, 38; ed. Lec., ii, 465; *A. pallipes* Dej., Sp. Gen., iv, 53; *A. dorsalis* Lec., Ann. Lyc. N. York, iv, 373.*

*The MS. descriptions and remarks of Dr. Zimmermann upon this and the next species are so important that I have translated them:

"*A. comma*. Abundant in the Northern States; $2\frac{3}{4}$ — $3\frac{1}{2}$ lines long.

"Altogether similar to *A. pallipes* in form and color, and usually confounded with it; differs in the marking of the elytra, upon each of which there is a black stripe, so that the suture remains yellow; this stripe extends from the first to the fifth stria, and is commonly abbreviated in front, sometimes, however, attaining the base, but never the suture. The dorsal spot of the prothorax is sometimes wanting; the hind angles are somewhat more obtuse, and the scutellar stria of the elytra longer than in the next species.

"*A. pallipes*. Abundant in the Southern States; 2—3 lines long.

"Body elongated, not very convex, testaceous; mouth, palpi, base of antennae, feet and anus reddish-yellow; under surface and head black; a large black or brown spot on the middle of the prothorax, and a broad black stripe on the elytra, which extends from the suture to the fourth stria, pointed in front and reaching the scutellum. Head with deep frontal impressions and moderately large eyes; prothorax narrowed behind; hind margin and shallow basal impressions thickly punctured; hind angles rather obtuse than rounded; elytra with deep, smooth striae, short scutellar stria and a distinct posterior dorsal puncture upon the second stria.

"*Remarks*.—It is obviously this species and not the preceding which Fabricius described from the Hunterian collection. This is apparent, not only in the words '*Coleoptera nigra limbo pallido*,' but also by the description and figure given by Olivier under the same name, with the additional remark that the insect was found in Carolina. *A. pallipes* Dej. is another species which is found in the Northern States, and described by Fabricius under the name *Cur. comma* in the following words: '*Elytra grisea, macula lineari nigra versus suturam*.' The specimen of *Carabus pallipes* in the Fabrician cabinet is a *Cymindis variegata* Dej., according to Schaum, Stettin Ent. Zeitung, 1847, 47.

1868.]

5. *A. pallipes* Lec., Ann. Lyc. N. York, iv, 373; *Carabus pallipes* Fabr., Ent. Syst., i, 159; Syst. El., i, 200; Oliv., 35, 121, pl. 9, f. 99; *A. Lecontei* Chaud., Rev. and Mag. Zool., 1868.

6. *A. rugicollis* Lec., Proc. Acad. Nat. Sci., Phil., 1859, 83.

7. *A. partarius* Chaud., Rev. and Mag. Zool., 1868; *Trechus part.* Say, Trans. Am. Phil. Soc., ii, 90; ed. Lec., ii, 504. Dr. Zimmermann believed that he recognized in this species *Carabus celer* Oliv., 35, 114, pl. 14, f. 168, to which the locality "Paris" was incorrectly given; he supposed that the specimen was found in Carolina by Bosc., from whose collection it was described.

8. *A. pauperculus* Chaud., Rev. and Mag. Zool., 1868; *Acupalpus paup.* Dej., Sp. Gen., iv, 463, *Ac. consimilis* Dej., ibid., iv, 465.

9. *A. indistinctus* Chaud., Rev. and Mag. Zool., 1868; *Acupalpus ind.* Dej., Sp. Gen., v, 846. Dr. Zimmermann determined this species as *Ac. humilis* Dej., ibid., iv, 462, which is referred by Chaudoir to *Stenolophus*; with about twelve specimens before me, I can perceive no greater sexual differences than those observed in other small species of this genus; a specimen determined by Zimmermann as *Ac. difficilis* Dej., Sp. Gen., iv, 435, does not differ, except in being of a uniform pale brown color and scarcely perceptibly more elongated. Should this synonymy be correct the species must be called *A. humilis*, the specific name under which it was first published.

10. *A. testaceus* Chaud., Rev. and Mag. Zool., 1868; *Acupalpus test.* Dej., Sp. Gen., iv, 460.

11. *A. micros* Lec., Ann. Lyc. N. York, iv, 412. My description mentions the only distinguishing character between this and the preceding, which is, that the scutellar stria, though short, is quite obvious.

STENOLOPHUS Dej.

In this genus the mentum is semicircularly emarginate, without median tooth; the front and middle tarsi of the male are dilated, and furnished beneath with two rows of squamiform papillæ. The form of the dilated joints enables the species to be divided into natural groups. Until the male is known, it is somewhat difficult to decide whether some of the smaller species should be referred to this genus or to *Ayonoderus*; but in doubtful cases, in the absence of specimens with dilated front tarsi, I have referred to *Stenolophus* all those in which the first and second joints of the hind tarsi are much longer than the third and fourth; in other words, those in which the hind tarsi are more slender, and the joints diminish in length more rapidly than in *Ayonoderus*.

Our species may be grouped as follows:

A. Body rather stout, prothorax but little narrower than the elytra; front and middle tarsi of male broadly dilated; fourth joint very deeply bilobed; scutellar stria long.

a. Sides of prothorax broadly flattened, scarcely reflexed.

7.5 mm. Black, not very shining; 1st joint of antennæ, tibiæ and tarsi brownish..... 1. *carbonarius*.

b. Sides of prothorax less broadly flattened, more strongly reflexed.

6.5 mm. Piceous black, shining; base of antennæ, margin of prothorax, epipleuræ and feet brown; basal impressions of thorax feebly and sparsely punctured..... 2. *spretus*.

c. Prothorax narrowly margined, margin not reflexed.

6.5—7 mm. Piceons with brassy lustre, margins of thorax and elytra testaceous, base of antennæ and feet more or less brown; prothorax subquadrate; basal angles nearly rectangular, rounded at tip, impressions finely punctured and rugose..... 3. *limbalis*.

7—7.5 mm. Black, shining, elytra piceous or testaceous, slightly iridescent, base of antennæ and feet more or less testaceous or brown; prothorax feebly

[Dec.

narrowed behind, hind angles obtuse rounded, basal impressions with a few scattered punctures, bead of lateral margin pale..... 4. *fuliginosus*.

5-5 mm. Black shining, base of antennæ and feet ferruginous, elytra slightly iridescent, margin brown; prothorax with the lateral bead brown, feebly narrowed behind, hind angles much rounded, basal impressions rounded, impunctured 5. *plebejus*.

3.5-4.5 mm. Smaller, piceous shining, sides of elytra and disc of prothorax frequently ferruginous, base of antennæ and feet ferruginous; prothorax feebly narrowed behind, hind angles very much rounded, not at all apparent; basal impressions small, rounded, feebly impressed, impunctured,

6. *conjunctus*.

4-5 mm. Similar to *conjunctus*, but narrower; black shining, margins of prothorax and elytra brown, base of antennæ and feet ferruginous; prothorax scarcely wider than long, not narrowed behind, hind angles much rounded, not at all apparent, basal impressions punctiform..... 7. *rotundatus*.

B.

Body more slender, prothorax evidently narrower than the elytra, front tarsi of male moderately dilated, 4th joint deeply bilobed, middle tarsi of male not dilated; elytra with long scutellar stria, more or less iridescent; base of antennæ and feet pale; hind angles of prothorax obtuse rounded.

a. Elytra more finely striate, middle tarsi of male with two rows of squamiform papillæ. (Pacific species.)

* Striæ deeper towards the tip.

6 mm. Blackish, with the margins paler; prothorax wider than long, scarcely narrowed behind, basal impressions broad, very feebly punctured.

8. *anceps*.

6-5 mm. Elytra black, with narrow pale margin; prothorax scarcely wider than long, narrowed behind, basal impressions faint, feebly punctured, disc yellow, with a large, somewhat bi-lobed black spot (elytral striæ deeper than in the preceding and next species)..... 9. *cincticollis*.

** Striæ not deeper towards the tip.

4.5-5.27 mm. Beneath and head blackish, antennæ, feet, prothorax and elytra testaceous; prothorax wider than long, narrowed behind, basal impressions narrow, not punctured; elytra with a faint dusky cloud behind the middle 10. *unicolor*

b. Elytra more deeply striate, striæ deeper towards the tip, middle tarsi of male without rows of squamiform papillæ.

8-5 mm. Larger, blackish, with the margins paler; prothorax wider than long, with the basal impressions broad, finely punctured..... 11. *flavipes*.

5.5-5.75 mm. Smaller, blackish, narrow margins paler, prothorax scarcely wider than long, basal impressions broad, sparsely but less finely punctured.

12. *ochropezus*.

5.5-7 mm. Prothorax testaceous, hind angles more rounded, basal impressions sparsely punctured; elytra iridescent black, with very wide testaceous side margin..... 13. *dissimilis*.

C.

Small species of elongate form; front tarsi of ♂ moderately dilated, fourth joint deeply emarginate, middle tarsi feebly dilated, with two rows of squamiform papillæ; elytra with long scutellar stria, base of antennæ and feet pale; hind angles of prothorax obtuse or subrectangular, less rounded than in B.

a. Elytra with but one dorsal puncture, as usual, on the second stria; hind angles of prothorax obtuse, somewhat rounded; frontal suture more distinct than usual.

3 mm. Head narrower than the prothorax, and almost as long; color scarcely brown, elytra darker, slightly iridescent, prothorax trapezoidal, but little broader than long, narrowed behind, rounded on the sides only before the middle; basal impressions broad, feebly punctured; eyes not prominent.

14. *hydropicus*.

2.5—3 mm. Head more distinctly narrower than the prothorax, with larger and more prominent eyes, otherwise quite similar to *hydropicus*, but more elongate and less convex; color variable, but the head is always dark and the elytra iridescent..... 15. *carus*.

b Elytra with several dorsal punctures; hind angles of prothorax rectangular, not rounded.

4 mm. Elongate, more depressed, head blackish, prothorax pale, with a large quadrate dusky spot; anterior transverse impression deeply marked, basal impressions broad, rugosely punctured; elytra pale, with a broad dorsal vitta divided by the suture and abbreviated at each end; dorsal punctures 3. Georgia, one specimen..... 16. *flavilimbus*, n. sp.

3.5 mm. Smaller and less depressed; head blackish, prothorax testaceous, basal impressions deeper, feebly punctured, elytra dusky, with the suture, base and margin testaceous; dorsal punctures 3..... 17. *longulus*.

3—3.25 mm. Still smaller, prothorax as long as wide, with the sides still more subsinuate behind, and the hind angles more prominent; basal impressions deep, punctured; color brown or blackish, paler at the margins; dorsal punctures 4..... 18. *rectangulus*.

D.

* Body more elongate and linear than in any of the preceding species: head as wide and nearly as long as the prothorax; front tarsi of ♂ moderately dilated, 4th joint bilobed, middle tarsi slightly dilated; prothorax narrowed behind, with flattened rectangular angles; elytra with long scutellar stria; palpi longer and more pointed than in the other groups of *PHILODUS* Lec.

a. Elytra each with three distinct rows of dorsal punctures.

4.25 mm. Testaceous, head and part of elytra dusky; basal impressions of prothorax large, deep, not punctured; body depressed; eyes small.

19. *alternans*.

b. Elytra with the rows of dorsal punctures obsolete, only the posterior puncture of the second stria obvious.

4.25 mm. Dark brown, prothorax paler, with the basal impressions less deep, but also not punctured; body less depressed, eyes larger and more prominent..... 20. *tener*.

Bibliography and Remarks.

1. *S. carbonarius* *Brullé*, Lec. Ann. Lyc. N. York, iv, 409; *Harpalus carb.* Dej., Sp. Gen. iv, 398.
2. *S. spretus* *Dej.*, Sp. Gen. v, 845.
3. *S. limbalis* *Lec.*, Rep. Pac. R. R. Surv., xi, 2, Ins. 28; *S. indistinctus* *Motsch.* Bull. Mosc., 1859, 2, 134.
4. *S. fuliginosus* *Dej.*, Sp. Gen., iv, 423; *Lec.* Ann. Lyc. N. York, iv, 410; *S. versicolor* *Kirby*, Faun. Bor. Am., iv, 46; *S. fuscipennis* *Lec.*, Ann. Lyc., N. York, iv, 410.
5. *S. plebejus* *Dej.*, Sp. Gen., iv, 424; var. immat. *S. fuscatus* *Dej.*, ibid. 426.
6. *S. conjunctus* *Lec.*, Ann. Lyc., N. York, iv, 410; *Trechus conj.* *Say*, Trans. Am. Phil. Soc., ii, 90, ed. Lec. ii, 504; *Acupalpus misellus* *Dej.*, Sp. Gen. iv, 467; *Ac. rotundicollis* *Hald.*, Proc. Acad. Nat. Sc., Phil., i, 302; *Ac. lugubris*, *Hald.*, ibid., i, 302. Found from the Atlantic to the Pacific.
7. *S. rotundatus* *Lec.*, New. Sp. Col., (Smiths. Inst.), 17.

[Dec.

8. *S. anceps* Lec., Pac. R. R. Expl., xi, 2, 28; *S. rotundicollis* Motsch. Bull. Mosc. 1852, ii, 135.
9. *S. cincticollis* Lec., Proc. Acad. Nat. Sc., Phil., 1858, 60.
10. *S. unicolor* Dej., Sp. Gen., iv, 411; Mannh. Bull. Mosc., 1843, 214.
11. *S. flavipes* Lec., Proc. Acad. Nat. Sc., 1858, 60.
12. *S. ochropezus* Dej., Sp. Gen., iv, 424; *Feronia ochr.* Say., Trans. Am. Phil. Soc., ii, 54; *S. convexicollis* Lec., Ann. Lyc., N. York, iv, 404.
13. *S. dissimilis* Dej., Sp. Gen., iv, 424.
14. *S. hydropicus* Lec., New Spec. Col. (Smiths. Inst.), 17.
15. *S. carus* Lec., ibid., 18.
16. *S. longulus* Lec., List Col. N. Am., 13; *Acupalpus long.* Dej., Sp. Gen., iv, 459.
17. *Acupalpus rectangularis* Chaud., Rev. and Mag. Zool., 1868.
18. *S. alternans* Lec., Trans. Am. Phil. Soc., x, 386; *Badister testaceus*|| Lec. Proc. Acad. Nat. Sc., Phil., ii, 252; *Aepus test.* Lec. Ann. Lyc., N. York, iv, 413, *Philodes alt.* Lec., Class. Col. N. Am., 1, 33.
20. *S. tener* Lec., Pac. R. R. Expl., xi, 2, Ins. 29; *Philodes tener* Lec., Class. Col. N. Am., i, 33.

BRADYCELLUS Er.

The elytra are obliquely but feebly sinuate at tip, and never subtruncate as in the species of *Stenolophus*.

This genus contains both large and very small species, and, like *Stenolophus*, may be divided into groups according to the dilatation of the male tarsi; it may be distinguished from the other two genera by the mentum being armed with a large acute tooth, though in some of the smaller species it is sometimes difficult to perceive this character without the aid of a compound microscope; and even then the tooth is sometimes rendered less apparent, when the ligula is extended, by the basal portion of that organ; I believe, however, that I have by careful examination satisfied myself of the existence of the mentum-tooth in all of the species which I now refer to the genus.

Some of the smaller species of division B closely resemble in appearance *Agonoderus*, but may be usually known by the more slender antennæ and hind tarsi, and by the much shorter scutellar stria, which is sometimes in fact entirely wanting; a reference to the mentum, to verify the proper character belonging to the genus, should be always made in doubtful cases.

Baron Chaudoir regards the 1st division as constituting a distinct genus, *Tachycellus* Moravitz, but in view of the sexual differences observed in *Stenolophus*, I am scarcely prepared to adopt his opinion; I prefer therefore, for the present, to group the species as follows:

A. Front tarsi of male moderately dilated, middle tarsi less dilated, with two rows of squamiform papillæ beneath; elytra with a long scutellar stria.

a. Basal bead of prothorax well defined for its whole extent.

10—11 mm. Ferruginous, elytra black, iridescent, deeply striate; prothorax scarcely narrowed behind, sides broadly rounded and widely depressed, hind angles obtuse, somewhat rounded; base finely punctured.... 1. *dichrous*.

9—10 mm. Color as in the preceding; prothorax narrowed behind, sides rounded in front, oblique behind; hind angles scarcely rounded; base finely punctured; basal impressions more strongly marked..... 2. *vulpeculus*.

8 mm. Black; prothorax narrowed behind with small basal impressions, hind angles obtuse, not rounded; antennæ and feet ferruginous.

3. *autumnalis*.

b. Basal line of prothorax interrupted or nearly obliterated at the middle.

5—6 mm. Blackish; bead of prothorax pale; elytra piceous or dark testaceous; body more slender; prothorax distinctly narrowed behind; hind angles obtuse rounded; basal impressions well marked, sparsely punctured; legs ferruginous, thighs and tips of tibiæ sometimes darker; 1st joint of antennæ pale..... 4. *badipennis*.

1868.]

7 mm. Black; prothorax and elytra testaceous, the former with a large quadrate black spot, the latter with a dusky cloud divided by the suture; body slender; prothorax distinctly narrowed behind; hind angles subrectangular, slightly prominent, not rounded; basal impressions broad, punctured; antennæ with joints 1—3 testaceous, legs testaceous.

5. *atrimedius*.

4.5 mm. Smaller, slender, ferruginous, upper surface pale, with the head and disc of elytra somewhat darker; prothorax distinctly narrowed behind; hind angles subrectangular, slightly prominent, not rounded; basal impressions broad punctured; antennæ with the joints 1—3 or 4 paler.

6. *nebulosus*.

5.5—6.5 mm. Black, shining, not iridescent; prothorax with the hind angles rectangular; basal impressions linear, strongly marked, smooth, or scarcely punctured; anterior transverse impression distinct, strongly angulated; upper part of tibiæ and 1st joint of antennæ dark testaceous.

7. *nigrinus*.

5 mm. Smaller than *nigrinus*, with the hind angles of prothorax distinctly obtuse, but not rounded; otherwise not different; perhaps only an individual variation..... 8. *tibialis*.

B.

Species of small size with the scutellar stria very short, or altogether wanting; front tarsi of male moderately dilated, middle tarsi not dilated nor furnished with squamiform papillæ.

a. Striæ of elytra perfect.

* Head finely and sparsely punctured behind.

5 mm. Black or piceous shining; prothorax wider than long, slightly narrowed behind, much rounded on the sides; hind angles rounded; basal impressions well marked, feebly punctulate; elytra with the humeri and sometimes the sides paler brown; base of antennæ brown... 9. *axillaris*.

4.5—5 mm. Blackish, with the first joint of antennæ, feet and elytra more or less testaceous; prothorax at tip and base sparse punctured, formed as in the preceding, but less rounded at the sides and hind angles; basal impressions well marked; elytra (when pale marked with a dusky dorsal cloud, when dark, with the suture and sides paler,) thinly clothed with short pubescence near the sides and tip; intervals usually sparsely and distinctly punctured at the sides, base and tip; (α. larger and broader, testaceous, trunk dusky; elytra scarcely punctulate, *B. nitens* Lec.)..... 10. *cognatus*.

** Head not punctulate; basal impressions of prothorax feeble.

† Basal impressions of prothorax smooth.

5 mm. Black, 1st joint of antennæ and feet testaceous yellow; prothorax much rounded on the sides, slightly narrowed behind; hind angles obtuse, scarcely rounded; basal impressions very feeble; scutellar stria entirely wanting..... 11. *cordicollis*.

†† Basal impressions of prothorax punctulate; scutellar stria represented by a puncture at the base of the 2d stria. Body elongate.

4—4.5 mm. Dark reddish testaceous, trunk black, antennæ with first two joints pale; prothorax a little wider than long, narrower behind, sides oblique near the base, but not sinuate; hind angles obtuse, almost rounded, not at all prominent; basal impressions broad, shallow, sparsely punctured; (only differs from the next by the hind angles of the thorax not being prominent, and is probably a race of it.)..... 12. *congener*.

4—4.5 mm. Usually testaceous, sometimes piceous, with pale margins; base of antennæ and feet yellow; prothorax a little wider than long, narrowed behind; sides subsinuate very near the hind angles, which are obtuse

[Dec

not rounded and slightly prominent; basal impressions broad, shallow, strongly punctured..... 13. *rupestris*.

4—4.25 mm. Blackish, margins brownish, feet and first two joints of antennæ yellow; prothorax as in *rupestris*, from which this species differs only by its darker color and more elongated form, and of which it seems to me to be a race..... 14. *parallelus*.

3.75 mm. Smaller, pale testaceous, metasternum and small elytral cloud dusky; prothorax nearly as wide as long, narrowed behind; sides obliquely subsinuate behind the middle; hind angles rectangular, not at all rounded; basal impressions broad, sparsely and finely punctured..... 15. *rivalis*.

3.75 mm. Less elongate than the others of this group; black, prothorax, elytra and feet testaceous; antennæ brown, with first 2 joints pale; prothorax wider than long, more narrowed behind; sides scarcely sinuate near the base, hind angles obtuse, very slightly prominent; basal impressions feeble, with a few punctures; eyes smaller and less prominent than usual. New Jersey and Virginia, two specimens 16. *nigripes*, n. sp.

3 mm. More elongate, black or piceous; antennæ and feet testaceous; the former sometimes brown, with two basal joints pale; prothorax but little wider than long, narrowed behind; sides scarcely sinuate near the base; hind angles obtuse, slightly prominent; basal impressions broad, sparsely punctured; eyes large, prominent..... 17. *tantillus*.

3—3.25 mm. Same form and color as the last, from which it differs only by the sides of the prothorax being distinctly subsinuate behind the middle and the hind angles nearly rectangular, not rounded, and somewhat prominent; the basal impressions are larger and more punctured; eyes large and prominent; antennæ brown, first two joints and feet testaceous.

18. *californicus*.

3.25 mm. Same form as the two preceding, but differing by the prothorax, the sides of which are obliquely rounded behind the middle, and the hind angles obtuse and rounded; basal impressions less deep, sparsely punctured; feet testaceous; antennæ dark piceous; first two joints testaceous.

19. *neglectus*.

b. Stria of elytra effaced, except the sutural one, which is deep; body rather stout and convex; prothorax not narrowed behind; sides subsinuate behind the middle; hind angles rectangular; basal impressions very feeble.

4.5—6.5 mm. Varies from testaceous to greenish black with a bronzed reflection; first two joints of antennæ and feet testaceous. Traces of a long scutellar stria are apparent in some specimens of this species, which thus differs from all the others in which the middle tarsi of the male are not furnished with papillæ..... 20. *nitidus*.

C.

This division contains but a single species of very elongate linear form, in which the eyes are much smaller and less prominent than in any other known to me; the prothorax much longer than wide, somewhat narrowed behind, broadly sinuate on the sides, which have the lateral bead much more strongly marked than in the other species; the basal impressions are long, narrow, deep and punctured; the hind angles rectangular; the elytra at the base are wider than the prothorax, very long and parallel, obliquely sinuate and subtruncate at tip; the striæ are deep, the scutellar is represented by a large puncture, and the second stria has a dorsal puncture behind the middle. The tibiæ are more spinous than in the other species, and the whole appearance of the insect is that of a small *Pterostichus*. The front tarsi of the male are feebly dilated, the middle tarsi without papillæ.

5.5 mm. Black, margins brownish; antennæ brown; first two joints and feet testaceous yellow; prosternum channeled between the front coxæ; peduncle of mesothorax coarsely punctured... 21. *linearis*.

1868.]

Bibliography and Remarks.

1. *B. dichrous Lec.*, Trans. Am. Phil. Soc., x, 385; *Harpalus dichrous* Dej., Sp. Gen., iv, 258; *H. iricolor* Say, Trans. Am. Phil. Soc., iv, 432.
2. *B. vulpeculus Lec.*, Trans. Am. Phil. Soc., x, 385; *Harpalus vulp.* Say, Trans. Am. Phil. Soc., ii, 30, ed. Lec., ii, 458; *ibid.* iv, 432, ed. Lec., ii, 545.
3. *B. autumnalis Lec.*, Trans. Am. Phil. Soc., x, 385; *Feronia autumn.* Say, Trans. Am. Phil. Soc., ii, 48, ed. Lec., ii, 473; *Geobænus autumn.* Lec., Ann. Lyc., N. York, iv, 403.
4. *B. badiipennis Lec.*, *ibid.*, x, 385; *Stenolophus bad.* Hald., Proc. Acad. Nat. Sc., Phil., i, 302; *Geobænus rufescens* Lec., Ann. Lyc., N. York, iv, 44; *Geobænus lugubris* Lec., *ibid.*, iv, 405.
5. *B. atrimediæ Lec.*, *ibid.*, x, 385; *Feronia atr.* Say, Trans. Am. Phil. Soc., ii, 39, ed. Lec., ii, 466; *Trechus similis* Kirby, Faun. Bor. Am., iv, 48.
6. *B. nebulosus Lec.*, *ibid.*, x, 385; *Acupalpus suturalis* || Lec., Ann. Lyc., N. York, iv, 411.
7. *B. nigrinus Motsch.*, Käfer Russl., 22; *Harpalus nigr.* Dej., Sp. Gen., iv, 399; Mannh. Bull. Mosc., 1843, 213, *ibid.*, 1852, 298; *Geobænus quadricollis* Lec., Ann. Lyc., New York, iv, 405.
8. *B. tibialis Lec.*, List of Col. N. Am. 12; *Trechus tibialis* Kirby, Fauna Bor. Am., iv, 46; *Geobænus tib.* Lec., Ann. Lyc., N. York, iv, 405.
9. *B. axillaris Lec.*, List of Col. N. Am. 12; *Acupalpus ax.* Mannh., Bull. Mosc., 1853, 124. I received a specimen of this species from Count Mnisech, under the name *Ac. conflagratus* Mann., *ibid.*, 126.
10. *B. cognatus Schiodte*, Danm. El., i, 158; ej. Naturhist. Bidrag. Grönland, 54; *Acupalpus cogn.* Dej., Sp. Gen., iv, 440; *Ac. longiusculus* Mannh., Bull. Mosc., 1853, 125; and *B. nitens* Lec., Proc. Acad. Nat. Sc., Phil., 1858, 60.
11. *B. cordicollis Geobænus cord.* Lec., Ann. Lyc., N. York, iv, 406.
This species has been accidentally omitted in my list of N. Am. Coleoptera.
12. *B. congener Lec.*, Melsh. Cat. Descr. Col., 25; *Geobænus cong.* Lec., Ann. Lyc., N. York, iv, 407; *B. nubifer* Lec., Pr. Ac., 1858, 60, is a pale variety from Arizona, having the trunk and a small dorsal elytral cloud dusky. *B. ventralis* Lec., *ibid.*, is a specimen with more numerous punctures at the base of the prothorax.
13. *B. rupestris Lec.*, Mels. Cat. Descr. Col., 25; *Trechus rupestr.* Say, Trans. Am. Phil. Soc., ii, 91, ed. Lec., ii, 505; *Geobænus rup.* Lec., Ann. Lyc., N. York, iv, 406; *Acupalpus elongatulus* Dej., Sp. Gen., iv, 457; *Trechus flavipes* Kirby, Fauna Bor. Am., iv, 47; *Stenolophus cinctus* Say, Trans. Am. Phil. Soc., iv, 434, ed. Lec., ii, 547.
14. *B. parallelus Chaud.*, Rev. et Mag. Zool., 1868; ? *Acupalpus debilis* Say, Trans. Am. Phil. Soc., iv, 425, ed. Lec., ii, 548.
15. *B. rivalis Lec.*, Proc. Acad. Nat. Sc., Phil., 1858, 60.
17. *B. tantillus Chaud.*, Rev. and Mag. Zool., 1868; *Acupalpus tant.* Dej., Sp. Gen., iv, 465.
18. *B. californicus, Stenolophus cal.* Lec., Pac. R. R. Expl., xi, 2, Ins., 29.
19. *B. neglectus Geobænus negl.* Lec., Ann. Lyc., N. York, iv, 407; *Stenolophus negl.* Lec., Trans. Am. Phil. Soc., x, 385.
20. *B. nitidus Mannh.*, Bull. Mosc., 1843, 214; *Acupalpus nit.* Dej., Sp. Gen., iv, 474.
21. *B. linearis Lec.*, New Spec. Col. (Smiths. Inst.), 16.
Acupalpus symmetricus Motsch., Bull. Mosc., 1859, 2, 134. I have not identified this species, but suspect it to be a Western race of *B. rupestris*.
Trechus immunis Kirby, Fauna Bor. Am., found in lat. 54°, I have not identified; it is perhaps *Stenolophus carus Lec.*, but the description is scarcely sufficient to warrant the placing of the latter in synonymy.
Geobænus arenarius Lec., Ann. Lyc. Nat. Hist., New York, iv, 403, referred by me (Trans. Am. Phil. Soc., x, 385) to *Bradycellus*, is proved by the discovery of the ♂ to belong to *Amara*, division *Liocnemis*.

[Dec.

The following reports were read and referred to the Publication Committee :

REPORT OF THE CURATORS.

Another year has passed with its usual addition of treasures to the Museum of the Academy, which has now become, from its exceedingly crowded condition, rather a rich store house of materials for the use of naturalists, than a convenient place of exhibition and study. A new and previously unforeseen incident has occurred during the year which greatly contributes to the necessity of our seeking other quarters. A huge store, recently erected in the rear of our building, so much diminishes the light from that direction, as greatly to interfere with the view of objects in the museum.

The trustees of the building fund of the Academy continue their efforts to procure means to provide proper accommodations for the purposes of the institution, not only suitable to its present condition, but having in view its future increase, but their means are not equal to what are desirable. Having obtained subscriptions from citizens of upwards of \$100,000, they have selected and purchased an ample piece of ground, in many respects well selected and located, at the south-west corner of 19th and Race Sts., opposite one of the finest public squares of the city. But the lot has cost upwards of \$60,000, and the estimates of an appropriate building approach \$300,000, which we see but little prospect of obtaining.

Many of the subscribers to the building fund and other citizens object to the location chosen, and consider that a position on Broad Street would be in many respects more desirable, and especially as it would there be more in the way of travel of those most interested in the institution. Admitting this view to be correct, a greater difficulty in the way of accommodating the Academy in this position, is the much greater value of the ground than in the locality already chosen.

Most of the members of the Academy, and numerous citizens hope and look for aid from our Legislature and City Councils, in the suggested appropriation of one of the Penn Squares for the uses of the institution. Taking the view that the Academy is virtually a public institution, of which its members are the trustees, and considering the importance it is to the intellectual interests of the public, it appears to us no more than a matter of justice that the city should be enabled to appropriate for the use of the Academy, what is now really a useless common. It is to be hoped that the efforts now being made by the Trustees of the Building Fund of the Academy, to obtain an act of the Legislature to permit our City Councils to appropriate one of the Penn Squares to our uses may prove successful. With such assistance, we could no doubt readily obtain the additional means to erect a suitable building for the Academy, one which, with its stores of intellectual treasures open free to the public, would become one of the most attractive features of Philadelphia.

The Museum collection is in good condition. Our thanks are due to Messrs. Isaac Burke and E. Dieffenbaugh, who have poisoned the entire American Herbarium, and are now engaged in doing the same with the General Herbarium. This is a most important work, ensuring the plants against the depredations of insects.

Among the most important and attractive additions made to the Museum during the year is the restored skeleton of the great extinct reptile *Hadrosaurus*, now occupying the fore part of the lower hall. The restoration is due to the accomplished natural history artist B. Waterhouse Hawkins, of London, and when we add that all the labor and expense attending the restoration was a voluntary contribution of the gentleman, we cannot too much express our gratitude to him.

The fine mounted specimen of the great extinct Elk, of Ireland, which has
1868.]

so long been a conspicuous object in the Museum, and which had been on deposit with the Academy, has now become its property, having been presented, together with other specimens of the same animal, by our fellow member, Mr. Joseph A. Wright.

In the month of December some thieves gained access to the Academy, and broke open several of the mineral cases, from which they abstracted a number of specimens, principally gold and precious gems. Fortunately most of the specimens have been recovered, and one of the thieves was apprehended and is now in prison.

During the year, notwithstanding the Academy was closed twelve of the usual visiting days, there were 65,769 visitors to the Museum.

The following is a synopsis of the donations made in the different departments of the Museum during the year.

Mammals.—Twenty-one species, besides two small collections, were presented by E. D. Cope, W. M. Gabb, H. Yarnal, I. I. Hayes and W. Raborg.

Birds.—Two small collections of birds and of nests and eggs, together with sixteen additional specimens, were presented by E. J. Lewis, E. D. Cope, W. S. Wood, J. D. Sergeant and C. S. Westcott.

Reptiles.—Prof. E. D. Cope presented a collection of 1465 specimens of 118 species from Pennsylvania, Virginia and Brazil; 40 species from Equador; four collections from Brazil, New Granada, Central America and elsewhere; and in addition, 33 species from Central America, the Rocky Mountains and elsewhere. Dr. George H. Horn presented a collection of 48 specimens of 16 species from Arizona and California; Dr. G. Linneecum, 104 specimens of 14 species of Texas; W. M. Gabb, 10 species from Lower California and Nevada; Ed. Day, a collection in 5 jars from Equador; and the Smithsonian Institution 20 species from Guayaquil, besides 8 species of *Amblystoma*. Others were presented by Dr. J. L. LeConte, Jos. A. Clay, C. B. Adams, C. Guillou, Dr. Randall and J. C. Brevoort.

Fishes.—Prof. Cope presented two collections in 30 jars from Kansas and New Granada, besides 23 species from the Potomac, the Wabash, New Jersey, and elsewhere. F. Sumichrast presented a collection of 86 specimens of six species from Mexico; Dr. Geo. Davidson, 15 species from Alaska; and Thomas Davidson, a collection from the West Indies.

Mollusks.—Many donations of mollusca have been made through the Conchological Department, for an account of which refer to the report of its Conservator.

In addition the Academy has received a large collection of unionidæ and other shells of the late Major LeConte, from Dr. John L. LeConte. Specimens were also received from J. R. Willis, W. M. Gabb, Dr. Genth and the Smithsonian Institution.

Articulates.—A collection of upwards of 600 species of exotic coleoptera, belonging to the late Dr. Zimmerman, was presented by Drs. John L. LeConte, Samuel Lewis, G. H. Horn, F. W. Lewis and Messrs. I. Lea, S. S. Haldeman and E. Draper. Dr. H. C. Wood presented 19 species of phalangidæ; J. R. Willis a small collection of crustacea, from Nova Scotia; and 14 species of myriapods, crustaceans, etc., were presented by W. M. Gabb, Geo. Davidson, J. L. LeConte, Edw. D. Cope, J. Lambert, H. Allen, and D. G. Brinton.

Radiates.—Nine echinoderms were presented by W. M. Gabb, Geo. Davidson and J. Adams.

Fossils.—Especially in the department of palæontology has the Museum of the Academy increased during the year. Besides the important addition mentioned in the introductory portion of the report, the following have been received.

A collection of about 3000 specimens of 500 species of fossils from the

[Dec.

triassic, cretaceous, and tertiary formations of California, Nevada and Oregon, deposited by Wm. M. Gabb. Many of the species are types described by Mr. Gabb.

A part of the Poirrier collection of remains of mammals, birds, and fishes from the miocene, pliocene and post-pliocene formations of the valley of the Loire, France, purchased at a cost of \$700, and presented by Messrs. Samuel and John Welsh, Isaac Lea, W. S. Vaux, and John Rice.

The greater part of the skeleton of an enormous extinct saurian, described by Prof. Cope, under the name of *Elasmosaurus platyurus*, from near Fort Wallace, Kansas, presented by Dr. Theop. H. Turner.

Two collections consisting of upwards of 1000 specimens of about 40 species of teeth of sharks and other fishes, and many specimens of 16 species of cetaceans, from the miocene formation of Charles Co., Maryland, presented by Prof. Edward D. Cope.

A collection of remains of *Laelaps* and other extinct reptiles from the marls of New Jersey, presented by Prof. Cope.

A collection of tertiary and cretaceous plants from Colorado, New Mexico, and Kansas, described by Lesquereux, presented by Dr. John L. Leconte.

L. P. Wheelock presented 58 fossils of the corniferous limestone of Ohio; Col. James Greer, 33 fossils from Ohio; and Rev. E. B. Eddy 17 fossils from Iowa.

Small collections from Ohio, Virginia, Pennsylvania, Maryland and Nova Scotia and elsewhere, were presented by E. D. Cope, Dr. O. A. Judson, W. M. Gabb, John R. Willis, F. A. Randall, and Dr. J. T. Rothrock. Sixty additional specimens were presented by E. D. Cope, W. M. Gabb, Dr. F. A. Hassler, J. Leidy, E. R. Beadle, Dr. F. V. Hayden, Dr. J. L. LeConte, C. W. Matthews, Gen. John Gibbon, R. H. Lamborn, Dr. N. R. Bradner, John Walton, W. Köhler, G. W. Hall, H. R. Parker and C. W. Peale.

Minerals.—Small collections were received from John R. Willis and C. Guillon, and 40 specimens were presented by Dr. F. A. Hassler, T. D. Rand, W. S. Vaux, E. Draper, T. Guilford Smith, F. Laverne, B. S. Lyman, E. R. Beadle, S. Tyson, Dr. J. Corse, Mr. Struthers, M. Phillips, T. F. Moss, F. V. Hayden, P. A. Snell, G. J. Ulex, B. A. Hoopes, Mr. Goldsmith and J. H. Claghorn.

Botany.—A collection of California plants were presented by Dr. W. P. Gibbons; 53 plants of New Jersey and Pennsylvania were presented by J. Burke and E. Diffenbaugh; and Dr. George Engelmann, of St. Louis, presented a copy of his *Herbarium of the North American Junci*.

Comparative Anatomy.—Dr. George Davidson presented skeletons of a male and female Otter, from Alaska. Dr. James L. Corse, presented a collection consisting of jars of embryo mammals, specimens for the microscope, entozoa, 7 human skulls, casts of 4, and the skeleton of an eagle. 23 skeletons, skulls and other specimens were presented by W. Bartram Snyder, I. I. Hayes, Joseph Jeanes, W. S. Vaux, Edward Cope, Wm. M. Gabb, O. N. Bryan, Prof. Von Siebold, of Munich, Edw. Davis, Dr. Genth, I. Lea, and E. J. Lewis.

Miscellaneous.—Specimens were presented by Joseph Henry Craven, Rev. A. Grout, J. R. Willis, Wm. M. Gabb, J. B. Ellis, E. Borda, G. H. Horn, Dr. J. A. McConnel, P. Crosby, S. Powell, Rev. W. E. Hunt, and the United States Sanitary Commission.

Respectfully submitted by

JOSEPH LEIDY,

Chairman of the Curators.

LIBRARIAN'S REPORT.

The Librarian respectfully reports that the number of additions to the Library from January to December, 1868, inclusive, amounts to 1323.

Of these there were volumes, 257; pamphlets, 1055; maps, &c., 11: Total, 1323. 33 were folios; 323 quartos; 952 octavos; 4 duodecimos, and 11 maps. 1868.]

These were derived from the following sources:

Editors, 159; Authors, 111; Societies, 636; Library Fund, 246; Wilson Fund, 105; Minister Public Works, France, 9; Messrs. Townsend & Adams, 8; Publishers, 8; Geol. Survey of Sweden, 4; Geol. Survey of India, 5; Geol. Survey of United Kingdom, 3; Treasury Department, 7; Navy Department, 1; B. Westermann & Co. 1; Wm. M. Gabb, 3; Jos. Jeanes, 1; Surgeon General, 1; Smithsonian Inst., 2; Dr. F. A. Hassler, 2; J. D. Sergeant, 4; Land Office, 1; S. S. Haldeman, 1; Wm. Warren, 1.

And were divided as follows:

Journals, 971; Geology, 80; General Natural History, 56; Entomology, 39; Botany, 28; Conchology, 24; Anatomy, 20; Physical Science, 17; Ornithology, 17; Voyages and Travels, 15; Bibliography, 9; Ichthyology, 9; Mammalogy, 6; Herpetology, 6; History, 8; Helminthology, 3; Mineralogy, 3; Chemistry, 1; Medicine, 1.

In addition to the above, eleven volumes and 113 pamphlets were presented through the Conchological section, making the entire increase 268 volumes and 1179 pamphlets, maps, charts, &c.

The total number of volumes now in the library is 21,964.

During the year 79 volumes have been bound, and 60 additional volumes are now in the hands of the binder.

For expenses of binding, amounts paid for books, salaries, &c., reference is made to the report of the Treasurer of the Academy.

To the list of missing books must be added the first volume of Hewitson's *Exotic Butterflies*, Bois-Duval and LeConte's *Lepidoptera of North America*, and Darwin's *Journal of Researches in the Beagle*, edition of 1845. Although search and inquiry have been made for these works, no information regarding their whereabouts has as yet been obtained. The loss of the first named is particularly unfortunate, as it breaks the suite of a valuable illustrated work, each volume of which is worth about \$25.00 in gold.

The Conchological department is so comparatively complete in itself that it is proposed as an experiment to number the works contained therein, with a view to extending the arrangement to the general library, if, after sufficient experience, it be found to be as beneficial as is anticipated. There is little doubt that the numbering of the books consecutively on the shelves and in the catalogues will greatly facilitate reference, while it will, it is hoped, tend to prevent misplacements and losses.

Owing to the very small amount of funds annually at the disposal of the Library Committee, but more especially during the past year, the number of books purchased for the use of the working members of the Academy has been entirely inadequate to their wants. The botanical and geological libraries are particularly deficient in the more important works recently published. These are mentioned especially, not because they stand alone in their imperfect condition, but because being most constantly referred to, they should receive the more immediate attention.

Three hundred dollars are annually received from the Wilson legacy, but, far from supplying the wants of the library, this amount is not sufficient to pay for the continuations of the works subscribed for by Dr. Wilson himself, and it has been necessary for the last two years to make up the deficiency from another source. Nor will the sum of \$1000.00, lately appropriated by the Academy, suffice to remedy the evil but for a very short time. This will be readily believed when it is known that the publication price of one work alone, which is required immediately, is \$320.00 in gold.

The Library Fund, by means of which many valuable works have been obtained, was exhausted during the past year, so that in the *immediate* future, at all events, no such source of supply will be at hand.

Under these circumstances the propriety of selling certain books in our possession, which have no direct connection with the Natural Sciences, has

[Dec.

been suggested. Some years since a large and valuable collection of French Historical Documents, given to the Academy by Wm. Maclure, was thus disposed of greatly to the advantage of the library.

The opinion is now entertained by some of the members of the Academy, that a similar disposition with similarly good results might be made of the collection of works on Antiquities and the Fine Arts now in our possession. This collection embraces some rare and valuable works which are practically worthless to the Academy. If sold to an institution or individual interested in the subjects treated by them, their usefulness would be greatly increased, while means would be provided for obtaining those works which are of the utmost importance to all those engaged in the study of the natural sciences.

All of which is respectfully submitted.

EDW. J. NOLAN,
Librarian.

REPORT OF THE RECORDING SECRETARY.

The Recording Secretary would beg leave to report,—

That during the year ending November 30th, 1868, there have been elected sixty-five members and twenty-one correspondents.

The death of the following members and correspondents have been announced.

Nine members, namely: Edw. B. Grubb, Tobias Wagner, Gen. Geo. A. McCall, Mr. Thomas Earp, Mr. C. F. Hagedorn, Mr. Isaac Barton, Mr. Matthew Newkirk, Mr. Jacob Gilliams.

Four Correspondents, namely: Rev. Mr. E. Johnson, Marcel de Serres, Sir David Brewster, Mr. Clot Bey.

The number of papers contributed and ordered to be printed in the Proceedings and Journal during the year has been forty-nine, as follows:

In the Proceedings thirty-six, namely:

| | | | |
|-------------------------|----|-------------------------|----|
| E. D. Cope..... | 12 | Isaac Lea..... | 8 |
| John Cassin..... | 1 | Thomas Meehan..... | 5 |
| Jacob Ennis..... | 1 | T. D. Rand..... | 1 |
| George N. Lawrence..... | 1 | W. B. Butcher, M.D..... | 1 |
| Elliot Coues, M.D..... | 2 | Alphonso Wood..... | 1 |
| Tryon Reakirt..... | 1 | Joseph Leidy..... | 11 |
| Thaddeus Norris..... | 1 | | |

In the Journal three, namely:

Isaac Lea, 1; Joseph Leidy, 1; E. D. Cope, 1.

All of which is respectfully submitted.

S. B. HOWELL,
Rec. Sec'y.

REPORT OF THE COMMITTEE ON HERPTOLOGY AND ICHTHYOLOGY.

The Committee on Herpetology and Ichthyology respectfully reports:

That there has been added to that part of the Museum under its care the following collections of Reptiles in Alcohol.

Duplicates of the collections made for the Smithsonian Institution in Vera Cruz, Mexico, by Francis Sumichrast, which are very extensive; the same of collections made for the same in high Guatemala, by Henry Hague; same of collections made in Yucatan, Belize and Tabasco, by Schott, Parsons and Berendt; with other duplicates of collections from Central America. Dupli-
1868.]

cates of collections made in Venezuela, and at Guayaquil, by Messrs. Destruges and Reeve. Duplicates also from the Smithsonian Institution from collections made in San Domingo, by W. Younglove; in Navassa, by W. Raisin; and in Porto Rico, by Geo. Latimer; from San Francisco, Cal., and from Vancouver's Island, made by A. W. Hewson. Also similar series from Arizona, collected by Elliott Coues, M.D., and from Camp Grant in the same Territory made by Dr. Canfield.

In the same manner the Committee has received duplicates of the collections of the Essex Institute, from Madagascar, Zanzibar and Western Africa.

There have been procured by exchange the large collections made by the Orton Expedition to Equador and the Upper Amazon; also collections from the Cape of Good Hope, the Seychelle Islands, and from Surinam by exchange with the Historical Society of Long Island.

By presentation the Committee has obtained a fine collection from Beirut, Syria, which also embraced mammals and other objects; similar collections from Bahia, Brazil; one from Central America, and two from unusual localities in New Grenada. Collections also from California and Lower California, and from Owen's Valley on the boundaries of Nevada. Also smaller collections from Australia, Africa, Persia and other places in Asia.

Of fishes there have been also numerous additions made to the charge of the Committee. They have not received much in this department by the duplicates of other museums, but have been chiefly dependent on presentation. In this way we have acquired large series of species from the Island of St. Kitts, West Indies, from St. Croix, West Indies, and from the Coasts of Alaska. Also from the rivers of South Western Virginia; from the Alleghany River above Pittsburg; from the branches of the Missouri River near Leavenworth, Kas., and from the Miami River, Ohio. All these are collections of considerable extent.

Smaller collections have been procured from Surinam, Central America, and Mexico; also from Beirut, Syria, and from Newport, Rhode Island.

The above collections, embracing a great number of specimens, were sorted, bottled, labelled, and classified in the Museum by the Museum Assistant, thus saving a great deal of time to the Committee, and enabling them to pursue scientific investigations on such and other material.

The Committee also congratulates itself on the benefits accruing to the committee's department, through the employment by the Curators of a French preparateur. Exclusive of numerous preparations in the department of birds and mammals, the committee have now a series of skeletons of forty species of Reptiles, and eighty of Fishes, obtained at rates far lower than by any other means known to the Committee. At the same time the Museum Assistant has received instruction in preparing skeletons and skins, thus supplying a want which the Committee's department and several other departments have experienced for several years past.

Which is respectfully submitted by

EDWARD D. COPE, *Chairman*.
ROBERT BRIDGES.

REPORTS OF THE CONCHOLOGICAL SECTION.

RECORDER'S REPORT.

During the year ending Dec. 3, 1868, there have been elected two members and four correspondents.

The death of one correspondent, Rev. E. Johnson, of Waioli, S. I., was announced Nov. 5, 1868.

Thirty-five papers have been accepted for publication in the Journal, by the following authors :

[Dec.

| | | | |
|-----------------------|---|---------------------|---|
| Prof. O. A. L. Mörch, | 1 | Geo. W. Tryon, Jr., | 8 |
| Wm. M. Gabb, | 7 | Dr. James Lewis, | 5 |
| Wm. Harper Pease, | 3 | T. A. Conrad, | 4 |
| Dr. J. G. Cooper, | 2 | S. R. Roberts, | 2 |
| Prof. S. S. Haldeman, | 1 | Thomas Bland, | 1 |
| Dr. P. P. Carpenter, | 1 | | |

The following amendment to the By-Laws was adopted, adding to Art. X of Chap. XII the words "or of the Academy;" so as to read: "The actual date of publication of any issue of the 'Journal' shall be determined by the published record of its presentation at a meeting of the Section or of the Academy."

Respectfully submitted,

S. R. ROBERTS, *Recorder*.

List of Members elected during 1868.—Mrs. Lucy W. Say, Dr. F. A. Hassler.

Correspondents.—G. B. Sowerby (elected in 1867), London; *Rev. E. Johnson*, Waioli, S. I. (deceased); Col. E. Jewett, Utica, N. Y.; Dr. Ferd. Stoliczka, Calcutta; Ralph Tate, London.

REPORT OF THE SECRETARY.

To the Conchological Section of the Academy of Natural Sciences, Philadelphia:

The Secretary would respectfully report that letters have been received as follows, since the last annual meeting, viz.:

Dec. 31, 1867.—Alpheus Hyatt, Salem, Mass., in acknowledgement of election as correspondent.

Feb. 4th, 1868.—Dr. O. A. L. Mörch, Copenhagen, acknowledgement of election.

Feb. 4th, 1868.—Jabez Hogg, London, with publications forwarded.

April 20th, 1868.—Robt. Dinwiddie, New York. Letter of thanks.

May 10th.—G. Nevill, Calcutta. Offering an exchange of specimens.

May 15th.—Prof. S. L. Abbott, Boston. Letter of thanks.

May 26th.—Prof. Jos. Henry, Smithsonian. Letter of acknowledgement.

June 13th.—Prof. S. F. Baird, S. I. Letter of thanks.

July 17th.—Dr. O. A. L. Mörch, Copenhagen. Letter of thanks.

Oct. 10th.—Dr. Ferd. Krauss, Stuttgart. Letter of thanks.

Letters have been written as follows, viz.:

April 3d.—To Edmund Draper, Thomas Sparks, and G. W. Fahnestock, of Philadelphia, tendering the thanks of the Section for subscriptions towards the purchase of specimens.

To Geo. Davidson, Germantown, for a fine suite of shells from Alaska.

August 17th.—To Jabez Hogg, London, requesting an exchange of publications.

To G. Nevill, Calcutta, accepting proposals for an exchange.

Nov. 2d.—To Dr. E. Von Martens, Berlin.

To M. F. de Malgivre, Bruxelles.

To Capt. J. Mitchell, Madras.

To M. Tasle, Pere, Varennes, France.

To Baron de Castello de Paiva, Lisbon.

To M. L. de Folin, Havre.

To M. Jules Chiron, Paris.

To Dr. Leopold Von Schenck, St. Petersburg, desiring an exchange of publications.

All of which is respectfully submitted.

E. R. BEADLE, *Sec'y*.

Dec. 3d, 1868.

1868.]

CONSERVATOR'S REPORT.

The Conservator of the Conchological Section respectfully reports that the following donations to the Cabinet have been received during the year :

Six hundred and sixty species of shells, principally from the collection of the late Hugh Cuming and for the greater part new to the museum, were presented, as follows : 267 species by Jos. Jeanes, 86 by Geo. W. Tryon, Jr., 46 by Thos. Sparks, 55 by Edm. Draper, 30 by C. F. Parker, 88 by Rev. E. R. Beadle, 45 by Isaac Lea, and by Wm. S. Vaux 42 species and a valuable specimen of *Cypræa umbilicata*.

From DR. JAS. LEWIS, seven species of fresh-water shells from the vicinity of Mohawk, N. Y. ; also specimens of *Melantho decisa*, Say ; *M. rufa*, Hald., and *M. integra*, Say.

S. R. ROBERTS. A suite of specimens of *Anodonta fluviatilis*, Soland., from Gray's Ferry, Philadelphia. Deformed specimens of *Anodonta implicata*, from Thorp's Dam, Philadelphia.

WM. M. GABB. About 3200 species, numerous specimens of marine, fluviatile and terrestrial shells.

GEO. W. TRYON, JR. Fifteen species of *Pupa* and *Vertigo*, and two specimens of *Bulimus Jaurassii*,

JOHN CASSIN. Six species from Natal.

J. R. WILLIS. Two specimens of *Pecten islandicus* from Nova Scotia.

E. R. BEADLE. Fifty-five species of marine, fluviatile and terrestrial shells.

E. HALL. Fifteen species.

W. H. PEASE. Four hundred and ninety-six species of Australasian shells, principally marine.

SPIRIDIONE BRUSINA. One hundred and ninety-nine species from the Adriatic Sea.

EDW. D. COPE. Six species of land shells from Western Virginia.

WM. G. BINNEY. *Helix Cooperi*, a unique specimen of an undescribed *Helicina*, and jaw of *Cylindrella trinitaria*.

GEO. DAVIDSON. Sixty-six species, numerous specimens of Alaskan shells.

ISAAC LEA. *Unio ligamentinus*, Lam. ; *U. Tappanianus*, eight species of *Unio* from North Carolina and Georgia ; *Eurycalon crassa*, Hald., *Amnicola Downiei* and three species of California fresh-water shells.

M. McDONALD. Many specimens of *Helix bucculenta* from Lexington, Va.

H. CROSSE. Eighty species, principally marine shells, from New Caledonia and the Adriatic Sea, and terrestrial shells from Dalmatia.

J. G. COOPER, M.D. Numerous specimens of California fluviatile and terrestrial shells.

PROF. O. A. L. MÜRCH. Seven species of fresh-water and land shells from Greenland.

F. V. HAYDEN, M.D. Nineteen species from Nebraska.

GEO. H. HORN, M.D. *Pisidium insigne*, Gabb, *Pupa Arizonensis*, *P. hordacea*, *Helix Hornti*.

SMITHSONIAN INSTITUTION. *Unio pliciferus*, Lea, *U. umbrosus*, Lea.

F. A. GENTH. *Unio merus*, Lea, *U. Uharcensis*, Lea, and *Clausilia Braunii*, Charp.

F. F. CAVADA. Nine species of shells from Cuba.

JOHN GREGORY. One species of *Cypræa* and one of *Cassidaria*.

JOS. LEIDY. Four species from Lake Superior, and two species of *Limniadæ* from Wyoming Territory ; *Planorbis trivolvis* and *Amnicola crassa*.

[Dec

J. A. McCONNELL. Pearls from Unios from Little Miami River, Warren Co., O.
JOHN FORD. Animal of *Pyrula canaliculata*.

R. E. C. STEARNS. Very fine specimens of forty species of west-coast shells.

DR. JOHN L. LeCONTE. One hundred and thirty-four species of Unionidæ, being the collection of the late Major John LeConte.

J. VAN A. CARTER. Four species from Dakota and Wyoming Territory.

T. N. DALE. Specimens of *Anomia epphipium*.

In presenting this list of the year's donations to the Conchological cabinet, amounting in the aggregate to about 6000 species, your special attention is called to the fine collection of upwards of 3000 species of marine, fluviatile and terrestrial shells presented by Mr. Wm. M. Gabb. This collection is particularly rich in west-coast species, and supplies a very large number of desiderata to our museum. The number of rare and interesting species in our possession has also been greatly augmented by the addition of the shells purchased by subscription from G. B. Sowerby, the greater part of which belonged to the collection of the late Hugh Cuming; by nearly 500 species of Australasian shells received from Mr. Wm. Harper Pease, of Honolulu; by the unique collection of Alaskan shells presented by Geo. Davidson, and by many rare and valuable species of Unionidæ contained in the LeConte collection.

Shells have been sent during the year in exchange to Dr. A. Brot, of Geneva, A. P. Terver, of Lyons, and W. Harper Pease, of Honolulu. For farther information regarding our foreign relations reference is made to the reports of the Corresponding Secretary and the Publication Committee.

Catalogues of all the families from Pholadidæ to Tellinidæ, inclusive, having been completed and published during the year, it is the intention of the Section to commence immediately the systematic arrangement of the Conchological collection. A number of members having volunteered to assist, the shells will now be cleaned, labelled and arranged as rapidly as circumstances will permit.

The Conservator has in his possession a photographic album containing sixty-one portraits of members of the Section and of distinguished Conchologists throughout the world. It is hoped that no opportunity will be neglected of soliciting contributions to this interesting collection from our correspondents.

In conclusion, the Conservator would congratulate the members of the Section that, from the successful operations of the past year, they have so much reason to draw encouragement for the future.

Respectfully submitted by

EDW. J. NOLAN, *Conservator*.

LIBRARIAN'S REPORT.

The Librarian respectfully reports that there have been presented during the past year to the library of the Conchological Section, 11 volumes and 113 pamphlets. Of these 58 were received from authors, 31 from editors, 15 from Societies, 7 from the Publication Committee, 4 from Geo. W. Tryon, Jr., 4 from John Cassin, 4 from H. Crosse and 1 from Wm. M. Gabb.

In addition, twenty-seven pamphlets and continuations of Conchological works have been received by the Academy.

In consideration of the comparative completeness of the Conchological Library, the Librarian proposes, with the sanction of the Library Committee, to number the works in this department at as early a date as possible. It is hoped that this plan will facilitate the work of those wishing to refer to the books, while it lessens the chances of volumes being lost or misplaced.

EDWARD J. NOLAN, *Librarian*.

The election of Officers for the ensuing year was held in accordance with the By-Laws, with the following result :

| | |
|--------------------------------------|---|
| <i>President</i> | ISAAC HAYS, M. D. |
| <i>Vice-Presidents</i> | Wm. S. Vaux, John Cassin. |
| <i>Corresponding Secretary</i> | Edw. D. Cope. |
| <i>Recording Secretary</i> | S. B. Howell, M. D. |
| <i>Librarian</i> | Edw. J. Nolan, M. D. |
| <i>Treasurer</i> | Wm. C. Henszey. |
| <i>Curators</i> | Jos. Leidy, M. D. Wm. S. Vaux, John Cassin, Edw. D. Cope, |
| <i>Auditors</i> | Jos. Jeanes, Wm. S. Vaux, Aubrey H. Smith. |
| <i>Publication Committee</i> | Jos. Leidy, M. D., Robt. Bridges, M. D., John Cassin, Wm. S. Vaux, Edw. J. Nolan, M. D. |

The following gentlemen were elected members :

Albert Peale, Franklin Platt, Jr., Edw. A. Spooner, M. D.

The following were elected correspondents :

Geo. Neville, of Calcutta, E. I., and Rev. Dr. Jos. F. Berg, of Rutgers's College, N. J.

ELECTIONS FOR 1868.

The following persons were elected Members :

Jan. 28.—Edward Goldsmith, Joseph F. Sinnott, Rufus Bucknell.

Feb. 25.—C. Newlin Peirce, D.D.S., Stephen Morris, Thos. T. Tasker, Jr., Stephen P. M. Morris, Henry G. Morris, Jas. E. Caldwell.

March 31.—Richard Peltz.

April 28.—H. C. Chapman, M.D., Charles Wilson Peale, Benj. Bullock, Thomas Webster, Dr. E. Dyer.

May 26.—Edward Lewis, Jas. Freeman, M.D., Wm. Freeman, M.D., S. Fisher Corlies, T. W. Starr, Edwin Rhoades, M.D., T. H. Andrews, M.D., Herbert Morris, M.D., Jas. S. Gilliams, Charles Bullock, Edward L. Huitt, Joseph Zentmayer, August F. Müller, F. F. Maury, M.D., Horace Williams, M.D., W. L. McFadden, Wm. H. Walmsley, Robert W. Hargadine, M.D., T. L. Buckingham.

June 30.—Gilbert Combs, L. S. Bolles, M.D., J. F. Holt, M.D., Isaac Comly, M.D., Francis P. Steel, Dr. Wm. Thomson, Rodger Sherman, John E. Carter, Wharton Barter.

July 28.—George Roberts, M.D., Levi Taylor.

Aug. 25.—B. Waterhouse Hawkins, Uselma C. Smith.

Sep. 29.—D. G. Brinton, M.D.

Oct. 27.—Philip S. Wales, M.D.

Nov. 24.—W. Mitchell McAllister, Emil Fischer, M.D. Isaac C. Price, Joseph G. Richardson, M.D., Wm. M. Darlington.

Dec. 29.—Albert Peale, Edwin A. Spooner, M.D., Franklin Platt, Jr.

The following were elected Correspondents :

March 31.—Major Geo. Clendon, Jr., Glens Falls, N. Y. ; Dr. Fred. Stoliczka, Calcutta ; R. H. Stretch, San Francisco, Cal.

April 28.—Dr. Theophilus H. Turner, U.S.A. ; Augustus Fendler, Allentown, Md.

May 26.—A. R. Roesler, Washington, D. C. ; Hon. J. S. Wilson, Washington, D.C. ; John Tomes, F.R.S., London.

June 30.—Dr. John F. Boynton, New York City, N. Y. ; Prof. James Orton, Rochester, N. Y.

July 28.—Wm. T. Bingham, Boston, Mass ; Alponse Milne Edwards, Paris, France ; Rev. Sam. Haughton, Dublin, Ireland ; W. Kitchen Parker, F.R.S., London ; T. Spencer Cobbott, M. D. ; London.

Aug. 25.—Ralph Tate, Lon. Eng. ; Prof. Oliver Wendell Holmes, Boston.

Oct. 27.—A. A. Breneman, Lancaster Co., Penn. ; Dr. L. E. Latimer, N. Y. ; Dr. H. Evan Rijgersma, St. Mortins, W. I.

Nov. 24.—Prof. H. James Clark, Centre Co., Pa.

Dec. 29.—Geo. Neville, Calcutta, E. I. ; Rev. Dr. Jos. F. Berg, Rutgers College, N. J.

CORRESPONDENCE OF THE ACADEMY, For 1868.

January.—La Société Hollandaise des Sciences, announcing that they have forwarded the Archives Néerlandaise, t. i, 3, 4, 5.

K. K. Zoologisch-botanische Gesellschaft, Wein, acknowledging receipt of Proceedings.

Geological Museum, Calcutta, with their publications for the Library.

Nassauischen Vereins für Naturkunde, Weisbaden, acknowledging receipt of Proceedings and sending publications in return.

Der Naturforschende Verein zu Riga, acknowledging receipt of Proceedings and with publications sent in return.

Geo. W. Davidson, Edinburg. Scotland.

Harrison Allen, resignation of office, Corresponding Secretary.

Real Observatorio de Madrid, with donations for Library.

February.—American Entomological Society ;

Der Naturwissenschaftliche Verein Lüneburg ;

Naturforschenden Gesellschaft, Berlin, severally acknowledging receipt of Proceedings.

Université Catholique de Louvaine, acknowledging receipt of publications of the Academy, and sending the publications of the University in return.

Die Naturhistorische Verein, Hanover, with publications.

Geo. Davidson, U. S. Coast Survey.

Gesellschaft der Wissenschaften zu Göttingen, with publications.

Thomas A. Scott, Phila.

B. Dyer, S. Abington, Mass.

D. E. Macpherson, conveying information of the death of Sir David Brewster, Feb. 10, 1868.

From Neuwied, conveying information of the death of Prinsen Maximilian zu Wied.

March.—Geological Museum, of Calcutta, India ;

Museum at Bergen, Norway ;

Essex Institute and Die naturforschende Gesellschaft, severally acknowledging receipt of Proceedings.

Universitatis Carolinæ Lundensis Rector.

Prof. Joseph Henry, Smithsonian Institution.

Chicago Academy of Natural Sciences, with transactions.

Canadian Sec. of State, with Report of the Progress of Canadian Geological Survey, from 1863 to 1866.

K. K. Zool. botan., Gessellschaft, with donations to the Library.

Edward L. Berthoud, Golden City, Colorado, acknowledging receipt of diploma.

April.—Rector de la Universidad de Chilé.

L. S. Ward, Treas. Foreign Missions, New York.

H. H. Jessup, Montrose, Pa.

R. Odinet, Agent of Havre, Boston and Philadelphia Steamship Company.

E. B. Cary, Ann Arbor, Mich.

G. Schwartz, Vienna, acknowledging election as correspondent.

H. B. Wetzell, Phila.

Samuel Jeanes, resignation of membership.

Naturkunde Gesellschaft in Württemberg, acknowledging receipt of Proceedings.

Naturwissenschaftliche Verein zu Bremen ;

Académie Royale de Belgique ;

Akademie der Wissenschaften, severally sending publications.

May.—Prof. Joseph Henry.

J. S. Wilson, Geological Museum, Gen. Land Office.

J. F. Williams, Sec. Minnesota Hist. Society.

Boston Society of Nat. History, acknowledging receipt of Proceedings and Journal and accompanied by publications in return.

Zoolog. Museum in Vienna, asking that deficiencies in Academy publications may be supplied.

M. Sumichrast Orizaba.

Jas. M. Fisher, Pittsburg, Pa.

S. A. Briggs, Chicago, Ill.

William Pepper, M. D., Phila.

Jas. Orton, Rochester, N. Y.

June.—John Henry Gurney, Devonshire, acknowledging election as Corresponding member.

A. Ten Brock, Librarian of the University of Michigan ;

Warren & Co., Liverpool Steamship Office ;

Antonio de Lacerda, Bahia ;

Alexander Schyanoff, Kiew ;

Lyceum of Natural Hist. of New York, each acknowledging receipt of Proceedings.

Naturforschende Gesellschaft in Dantzic, acknowledging receipts of Proceedings, and presenting publications in return.

La Fondation Teyler à Harlem, presenting publication.

July.—Wharton Barker, acknowledging election.

Essex Institute, acknowledging receipt of Proceedings.

Prof. Joseph Henry, Smithsonian Inst.

A. R. Roessler, Washington, Gen. Land Office.

G. W. Coan, Oroomiah, Persia.

Franz Baumgartner, announcing the death of Andreas Freiherrn von Baumgartner.

Real Observatoire de Madrid, with donation for Library.

August.—Royal Geog. Soc. London, sending 37th vol. of Journal.

D. G. Brinton, acknowledging election.

Académie Royale de Belgique, acknowledging receipt of Proceedings.

Nat. Hist. Society of Northumberland, announcing the sending of Nat. Hist. Transactions, and asking for papers in return.

Hungarian Academy of Science, acknowledging receipt of Proceedings and presenting books to the Library.

British Museum ;

Geological Society of London, each acknowledging receipt of Proceedings and Journal.

Linnean Society acknowledging receipts of Jour. and Proceed.

Prof. Joseph Henry.

Edward C. H. Day, Scarsdale, N. Y.

James Orton, Rochester, N. Y.

Dr. G. Radly, Tiflis.

T. H. Turner, Fort Wallace, Kansas.

Alexander Clot Bey, announcing the death of Monsieur Antoine Barthélemy Clot Bey.

September.—Leeds Philosophical and Literary Society ;

Naturforschende Verein in Brünn ;

Natural Hist. Society of Northumberland, each acknowledging receipt of Proceedings.

American Pharmaceutical Association, acknowledging receipt of invitation to visit Museum of the Academy.

W. W. Keen, M. D., Phila.

J. A. Allen, Springfield, Mass.

James Orton, Rochester, N. Y.

October.—Smithsonian Institution, acknowledging receipt of Proceedings.

Essex Institute, acknowledging receipt of Proceedings.

E. C. Bolles, asking for copies of Journal.

Jas. Orton.

Mahlon Carver.

John S. Hart, of Trenton Normal School, asking privilege of using the Museum

Prof. C. Root, of Hamilton College, acknowledging election.

November.—Jas. D. Dana.

A. R. Roessler, Gen. Land Office.

Thomas Barnett, with casts for the Museum.

Augustus Fendler, acknowledging election.

John Akhurst.

December.—Die Gesellschaft der Wissenschaften, acknowledging receipt of Proceedings and presenting publications.

Schweizerische Gesellschaft and Naturforschende Gesellschaft, each acknowledging receipt of Proceedings and presenting publications in return.

Die Senckenbergische Naturforschende Gesellschaft, presenting publications.

Wm. T. Brigham, Boston.

Prof. O. W. Holmes, Boston.

Whole number of letters received 98.

DONATIONS TO THE MUSEUM.

1868.

(For donations to Conchological cabinet, see Report of Conservator of Conchological Section.)

Adams, C. B. *May 5th.* Celestus impressus, Jamaica.

Adams, J. *July 7th.* Coral.

Allen, Dr. H. *July 7th.* Astacus from Ockoganey River.

Beadle, Rev. E. R. *Nov. 3d.* Gigantic crystal of Felspar from Newcastle Co., Del.; eight specimens of Numulitic limestone from Northern Syria; block of permian limestone from Junction City.

Borda, E. *March 10th.* Specimen of fruit.

Bourquin, F. *July 7th.* Dryopteris, Polypodium.

Bradner, Dr. N. Roe. *Dec. 1st.* Large specimen of Shell Rock from the reefs of Florida.

Brevoort, J. C. *Nov. 3d.* Loxopholis rugiceps, Cope, from New Grenada.

Brinton, Dr. D. G. *Nov. 3d.* Queen Termite from Cape Palmas, Africa.

Bryan, O. N. *May 5th.* Skulls of two species of Lepidosteus.

Burk, I. and E. Diffenbach. *Jan. 21st.* A collection of 53 plants of Pennsylvania and New Jersey.

Claghorn, Jas. H. *Nov. 3d.* Stalactite from Cave of Addelsburg, Austria.

Clay, Jos. A. *Jan. 21st.* A serpent from Peru.

Cope, E. D. *Jan. 7th.* One reptile from Brazil, 45 specimens, 9 species of fishes from Conestoga River; 164 specimens, 15 species from Roanoke River; 151 specimens, 34 species from James River, Va.; 644 specimens, 26 species from Kanawha River, Va.; 460 specimens, 33 species from Holston River. *Jan. 14th.* A collection of upwards of 1000 specimens. 40 species of teeth of sharks and other fishes from the miocene of Charles Co., Md. *Jan. 21st.* Five species of fishes from Potomac River, 10 species from Wabash River, and 9 species of reptiles from Rocky Mountains. *Feb. 4th.* Seven species of skins of fishes, many specimens from Brown's Mills, N. J.; small collection of subcarboniferous fossils from west side of Saltville, and from Walker's Mt., Smith Co., Va.; small collection of

- coal plants and specimens of coal from carboniferous formation of Richmond, Va.; skins of *Arvicola pinetorum*, *A. Pennsylvanica*, *Scalops Canadensis*, *Jaculus Hudsonius* and *Blarina Carolinensis*, from Charles Co., Md. *March 3d.* Eighteen species of Reptiles, one Crustacean, one Insect, from Central America. *March 10th.* Large serpent from Vera Paz, C. A., and a small collection of mammals and birds in alcohol from Giles Co., Va. *May 6th.* Specimens of *Neotoma Floridana*, Austinville, Wythe Co., Va.; *Heterodon* from Saltville, Va.; *Celestus striatus*, Jamaica; and a snake from Central America. *May 19th.* Nineteen jars of fishes, from Kansas; skull of *Globiocephalus melas*, from New Jersey. *June 2d.* A collection of fossil Unionidæ, from the green sand of New Jersey; numerous remains of *Lelaps aquilungus*, from the green sand of Barnsboro', Gloucester Co., N. J.; femur of *Hadrosaurus Foulkii*, from the same locality. *June 23d.* *Megaptera pusilla*, Cope, from the miocene, Charles Co., Md.; *Ixacanthus velox*, Cope, from same locality. *July 7th.* Skeleton of *Aspidonectes spinifer*, from Alleghany River, Pa.; a Skate from Syria. *July 21st.* Five mammal skins; a red squirrel; *Jacare punctatula*; twenty-two jars of reptiles, fishes, &c., from Magdalena River, New Grenada. *Sept. 1st.* A collection of mammals and reptiles in ten jars, from Bahia, Brazil; six bird skins from St. Bartholomew, W. I. *Sept. 15th.* Fourteen jars of reptiles, containing fourteen species from various localities. *Nov. 3d.* Collection of remains of sixteen species of extinct Cetacea from the miocene of Charles Co., Md.; mounted skeleton of *Palumedeæ cornuta*; a collection of forty species of reptiles of the Orton Expedition to Ecuador; a collection of reptiles from Brazil and Central America. *Nov. 10th.* *Crocodylus Americanus* from Cuba. (See Welsh.)
- Corse, Dr. J. M. *Dec. 1st.* Four skulls and casts of faces of noted murderers; numerous jars of embryo sheep of various ages, parasitic animals, fine injections for microscopic observation, and various specimens in comparative anatomy; skull of a Flat-head Indian; two skulls from an Indian mound near Rock Island, Ill.; skeleton of an Eagle; specimens of copper ore.
- Craven, Joseph H. *July 7th.* Beautiful specimen of *Euplectella*.
- Crosby, Peirce. *Aug. 4th.* Specimen of Fruit from Para, Brazil.
- Davidson, Geo. *Jan. 7th.* Five specimens of the male and female skeleton of the Sea Otter, from Alaska. *March 3d.* Fifteen specimens of Fishes, 3 Echinoderms and 2 Crustacea from Alaska.
- Davidson, Thos. and George. *Aug. 4th.* Large and valuable collection of Fishes from Santa Cruz, West Indies.
- Davis, Edw. *July 21st.* Pair of antlers.
- Day, Edw. *Sept. 1st.* A collection of Reptiles in five jars, from Ecuador.
- Dieffenbaugh, E. See Burk.
- Draper, E. *Jan. 14th.* Fine specimen of Pyrites with Blende from Mexico, and specimens of Quartz with Chalybite.
- Eddy, Rev. E. B. *May 5th.* A collection of fossils, consisting of a large coral and 16 brachiopods.
- Ellis, J. B. *March 3d.* Specimen of Tuckahoe, from Newfield, N. J.
- Engelmann, G. *April 21st.* Herbarium *Juncorum Boreali Americanorum* Normale ed. G. Engelmann. St. Louis, 1868.
- Gabb, Wm. M. *Jan. 7th.* Forty-five specimens, thirteen species of Reptiles from California. *Jan. 14th.* Skin of *Taxidea Berlandieri*, from Central Nevada; four species of Serpents from Lower California; two specimens of a Myriapod and nest of a *Mygale* from California. *Jan. 21st.* Two bats from Pigeon Springs, a small Rodent from Western Nevada, and a *Crotaphytus* from same locality; skull of a hare; skins of four species of snakes from Lower California. *Feb. 4th.* Two specimens of *Onychoteuthis fusiiformis*, Gabb, from Society Islands; five species of Echinoderms from California; two species of Crustaceans from St. Barbara, Cal.; *Hyalonema Sieboldii* from Japan. *May 5th.* *Eutænia vagrans* from Nevada. *Oct. 13th.* An Agouti from Panama. *Oct. 20th.* Two specimens of fossil

- fishes from Hillsborough, N. B. *Nov. 3d.* Collection of Graptolites, nine species, from Hudson River group, two miles below Albany, N. Y. *Nov. 10th.* A small collection of remains of fishes from the cretaceous formation of California. *Dec. 1st.* A large collection of fossils, consisting of about 500 species and 3000 specimens, belonging to the triassic, cretaceous and tertiary formations of California, Nevada and Oregon, deposited.
- Genth, Dr. F. A. *Aug. 4th.* Specimens of *Clausilia Braunii*, Charpentier, from Weinheim, Hesse Darmstadt; ear-bone of Whale from Gulf of California.
- Gibbon, Gen. John, through Dr. Wilcox. *Aug. 12th.* Baculite from near Fort Sanders, Dakota.
- Gibbons, Dr. W. P., through Dr. Bridges. *Jan. 7th.* A collection of one hundred and seventeen California plants.
- Goldsmith, E. *Oct. 20th.* Bole from South Amboy.
- Greer, Col. Jas., through Dr. Ruschenberger. *Dec. 1st.* Five Devonian fossils from Columbus, Ohio; 26 Lower Silurian fossils from Dayton, Ohio; fragment of wood from Drift from Dayton, Ohio; fossil Coral from near same locality.
- Grout, Rev. A. *Jan. 21st.* Ten species of Invertebrates and one Vertebrate, from Tulu Land, S. Africa.
- Guillon, C. *July 7th.* A small miscellaneous collection of Minerals. *July 14th.* Fine *Testudo geometrica*, from Madagascar.
- Hall, Geo. W. *March 3d.* Mastodon tooth from Illinois.
- Hassler, Dr. F. A. *Dec. 22d.* Celestine from Sicily; one Coal, two Hematites from Bibb Co., Ala.; Hematite from Missouri; Mica from Philadelphia, and nine specimens of Coal Fossils from Rhode Island and Mauch Chunk, Pa.
- Hayden, Dr. F. V. *April 21st.* Lignite from Colorado, a number of *Ostrea subtrigonalis*, and an *Inoceramus* from Colorado.
- Hayes, Dr. I. I. *July 7th.* Two skulls of Walrus and two of Esquimaux Dogs.
- Hoopes, B. A. *Oct. 13th.* Fine large crystallized Calcite from Cumberland, England.
- Horn, Dr. Geo. H. *Jan. 7th.* Three species of Reptiles from Arizona. *Feb. 4th.* Fresh-water Sponge, near Susanville, Honey Lake Valley, Cal.; tin ore from Temescal, Cal. *April 21st.* *Pisidium* from Fort Tejon, Cal.
- Hornet's nest. *Jan. 7th.*
- Hunt, Rev. W. E. *Nov. 3d.* Fragment of Ancient Pottery and Human Bones, with the greater portion of a Skull from Coshocton, Ohio.
- Jeanes, Jos. *July 7th.* Skeleton of Jackal, from Syria.
- Judson, Dr. O. A. *Jan. 21st.* A small collection of Fossils from Pike Co., Pa., and the fossil rib of a Cetacean from Virginia.
- Kokler, Wm. *Dec. 1st.* Four Fossils from Hannover, Germany.
- Lambert, J. *June 23d.* A large Spider from Montgomery Co., Pa.
- Lamborn, R. H. *Nov. 3d.* Two obscure Fossils from Huronian Slate, St. Louis R., Min.
- Lavergne, Felix. *Oct. 13th.* Three specimens of native Sulphur from Nevis, W. I.
- Lea, I. *Dec. 1st.* Skull of the Mississippi Snapper. (See Welsh.)
- LeConte, Dr. J. L. *Jan. 14th.* A Serpent, Spider, Cicada, two Myriapods, and a Lizard from Fort Craig, N. M. *April 21st.* A collection of Fossil Tertiary and Cretaceous Plants, (recently described by Mr. Lesquereux) from Colorado, New Mexico and Kansas, an *Inoceramus* from Colorado. *May 19th.* A collection of upwards of 6000 species of exotic Coleoptera belonging to the late Dr. Zimmerman. Presented by Dr. J. L. LeConte, Dr. E. J. Lewis, Dr. Geo. H. Horn, Dr. F. W. Lewis, Isaac Lea, S. S. Halde-
man and E. Draper.
- Leidy, Dr. Jos. *June 2d.* *Stigmaria* and other coal plants, six species.
- Lewis, Dr. E. J. *Jun. 7th.* Portion of the Jaw of a Fish. *March 17th.* One *Nyctale Acadica*, 2 *Cardinalis Virginianus*, *Sialia Wilsonii*, *Picus Pubes-*

- cens, from Harford Co., Md. *Oct. 13th.* Large collection of Nests and Eggs of Birds, from Harford Co., Md.
- Linnecum, Dr. G. *Jan. 7th.* One hundred and four specimens, fourteen species of Reptiles from Texas.
- Lyman, B. S. *Nov. 3d.* Asphaltum from Trinidad and Matanzas, Cuba; crystals of Smoky Quartz, from Mt. St. Gothard, Sd.
- Matthews, C. W. *May 5th.* Sigillaria from Lawrence Co., Ala.
- Meehan, Thos. *Jan. 7th.* Two fossil remains of Fishes, *Amphidectes Gladiolus*, Cope, and *Polygryphus prehensilis*, Cope; from Sandusky, Ohio.
- Moss, Theo. F. *March 24th.* Crystallized Titanium, from Scotland.
- Parker, H. R. *April 14th.* A large Devonian Fossil from Oil Creek, Venango Co., Pa.
- Peale, Charles W. *June 23d.* Calamite from Shamokin, Cumberland Co.
- Pennock, Homer. *July 7th.* Five fortification Agates, deposited.
- Philips, Moro. *June 2d.* Three specimens of Ossite from Sombrera, W. I., and a specimen of the same from Ashley River, S. C.
- Powell, Saml. *Sept 1st.* A miscellaneous collection of Marine Animals, consisting of Fishes, Mollusks, Echinoderms, Crustaceans, &c., from Newport, R. I.
- Raborg, Wm. *Nov. 3d.* *Chrysothrix Sciureus*, from Amazon River.
- Rand, Theo. D. *March 3d.* Stilbite from Flat Rock Tunnel. *March 10th.* Graphic Granite and Muscovite with Magnetic Iron.
- Randall, F. A. *Sept. 1st.* Two jars of Reptiles from Warren Co., Pa. *Oct. 20th.* A small collection of Paleozoic Fossils.
- Rice, John. See Welsh.
- Rothrock, Dr. J. T. *March 17th.* A small collection, chiefly of Devonian Fossils, from Mifflin, Alleghany and Centre Co's, Pa.
- Salt Works, Washington Co., Va. *Feb. 4th.* Tusk, molar tooth and epiphysis of humerus of Mastodon and ramus of lower jaw of a Bison.
- Sergeant, J. D. *Oct. 13th.* Nest of the Baltimore Oriole, made exclusively of wool and horse-hair, from Western Pennsylvania.
- Siebold, Prof. Von. *May 19th.* Teeth of seven species of Cyprinidæ, with many varieties of specimens.
- Skin of an Eel, which weighed $9\frac{1}{2}$ lbs., and was caught in Hunter's Lake, Sullivan Co., Pa.
- Smith, T. Guilford. *March 24th.* Five specimens of Gold Ores from Colorado.
- Smithsonian Inst. *May 5th.* Eight species of *Amblystoma*. *Aug. 12th.* *Anodonta Yonkanensis*, Lea. *June 2d.* Twenty species of Reptiles from Guayaquil, Quito and Upper Amazon.
- Snell, P. A. *March 10th.* Mass of calcareous Tufa from Utica, Ill.
- Snyder, W. B. *May 19th.* Indian Skeleton, &c., from a mound at Bellevue, Nebraska.
- Struthers, Wm. *Oct. 13th.* Conglomerate from the red sandstone of Portland, Con.
- Sumichrist, F. *Jan. 7th.* Eighty-six specimens, nine species of Fishes from Mexico.
- Turner, Dr. Theo. H. *Dec. 15th.* A collection of fossil remains of a huge Saurian, comprising the greater part of the skeleton, described by Prof. Cope under the name of *Elasmosaurus*, from about 15 miles of Fort Wallace, Kansas.
- Two fossil Fishes from Solenhofen Slate.
- Tyson, Saml. *Oct. 20th.* Three specimens of Wavellite from Chester Co.
- Ulex, Geo. J. *May 19th.* Specimen of Struvite from Hamburg.
- United States Sanitary Commission. *Dec. 15th.* A set of instruments consisting of an Andrometer, Spirometer, Dynamometer, Facial-Angle Instrument and Callipers, for Anthropological measurements.
- Vaux, Wm. S. *March 3d.* Fine specimen of Phlogopite, Rossie, St. Lawrence Co., N. Y. *March 24th.* Skull of *Chelone Mydas*. *July 7th.* Skel-

- eton of Fox from Syria. *Oct. 6th.* Very fine specimen of Tetrahedrite, coated with Pyrites from Liskeard, Cornwall. (See Welsh.)
- Walton, Jos. *May 6th.* Two tertiary fossil Shells from Aquia Creek, Va. *Acantharchus promotis* from New Jersey. *Sept. 1st.* A Silurian Fossil from the Catskill Mts.
- Welsh, Saml. and John. *Dec. 22d.* A portion of the Poirrier Collection of Remains of Mammals Birds and Fishes from the Miocene, Pliocene and Post-Pliocene formations of the Valley of the Loire, France. Purchased at a cost of \$700.00, and presented by Messrs. Samuel and John Welsh, Isaac Lea, Wm. S. Vaux, Wm. P. Wilstach and John Rice. Obtained through Prof. E. D. Cope.
- Westcott, Chas. S. *Dec. 1st.* Mounted specimen of a Goshawk, *Astur palumbarius*, from Monroe Co., Pa.
- Wheelock, L. P. *Feb. 4th.* A collection of 58 specimens of fossils, consisting of remains of Fishes, Mollusks and Corals, from the corniferous limestone near Sandusky, Ohio.
- Willis, J. R. *Jan. 14th.* A collection of Coal Fossils, Minerals, Shells and Crustaceans from Nova Scotia. *Jan. 21st.* Eight species of Fishes from Nova Scotia; six Invertebrates from same locality.
- Wilstach, W. P. See Welsh.
- Wood, Dr. H. C. *May 6th.* A collection of 19 bottles (containing numerous specimens) of as many species of Phalangidæ.
- Wood, Wm. S. *Oct. 13th.* Young of *Cyanura cristata*, *Picus pubescens* and *Melospiza melodia*, from New Jersey.
- Wright, Jas. A. *March 17th.* A complete articulated skeleton of the Irish Elk, (*Cervus Hibernicus*) together with the skull and fore part of the other bones of another skeleton.
- Yarnal, H. *June 23.* Deer from near Kane, McKean Co., Pa.

DONATIONS TO THE LIBRARY.

1868.

JOURNALS AND PERIODICALS.

NORWAY.

- Christiana. Det Kongelige Norske Fredericks Universitets, Aarsberetning for Aaret 1866—1867. From the University.
- Forhandlingar i Videnskabs-Selskabet i Christiania. Aars 1865 and 1866, 1866—1867. From the Society.
- Throndhjem. Det K. Norske Videnskabers-Selskabs Skrifter det 19de Aarhundrede. 5te Bands, 1ste Heft, 1865. Also from 2 Band, 1ste Heft, to 4de Band, 1ste Heft, 1824—1846. From the Society.

DENMARK.

- Kjbenhavn. Oversigt over det Kongelige Danske Videnskabernes Selskabs. 1866, No. 7; 1867, Nos. 4 and 5. From the Society.
- Mémoires de la Société Royale des Antiquaires du Nord, 1850—1860, 1861, 1866. From the Society.
- Tillaeg til Aarbger for Nordisk Oldkyndighed og Historie, aargang 1866—1867. From the same.
- Det Kongelige Danske Videnskabernes Selskabs Skrifter, Sjette Bind, and Femte Raekke, Syvende Bind, 1867. From the Society.

RUSSIA.

- Dorpat. Sitzungsberichte der Naturforschenden Gesellschaft zu Dorpat in den Jahren 1853—1863. From the Society.
- Archiv für die Naturkunde Liv-Ehst und Kurlands. Herausgegeben von der Dorpater Naturforscher Gesellschaft. Erste Serie. 3er Band, 3e and 4e Lief.; 4er Band, 1e Lief., zweite Serie. Biologische Naturkunde, 6er Band, 1e und 2e Lief., 7er Band, 1e Lief., 1862—1867. From the Society.
- Moscou. Bulletin de la Société Impériale des Naturalistes de Moscou, 1867, Nos. I—IV. From the Society.
- Riga. Correspondenzblatt des Naturforscher Vereins zu Riga, 16er Jahrg, 1867. From the Society.
- St. Petersburg. Bulletin de l'Académie Impériale des Sciences de St. Petersburg. Nos. 2—5, 1868. From the Society.
- Memoires de l'Académie Impériale des Sciences des St. Petersburg. VIIe Serie, Tome XI. Nos. 9—18, 1868. From the Society.

HOLLAND.

- Amsterdam. Jaarboek van de Koninklijke Akademie van Wetenschappen 1866. From the Society.
- Verslagen en Mededeelingen der K. Academie van Wetenschappen. Afdeling Letterkunde. Tiende Deel, 1866. From the Society.
- Processen-Verbaal van der Gewone Vergaderingen der Koninklijke Akademie van Wetenschappen. 1866—7. From the Academy.
- Rapport fait a l'Académie Royale des Sciences des Pays-Bas, section Physique. 1868. From the Academy.
- Harlem. Archives du Musée Teyler. Vol. 1, Fasc. 1, 2 and 3me, 1868. From the Museum.
- Archives Neerlandaises des Sciences Exactes et Naturelles; published by the Dutch Society of Sciences. Vol. 2, Parts 3, 4 and 5. La Haye, 1867. From the Society.

GERMANY.

- Altenburg. Mittheilungen aus dem Osterlande; published by the Gewerbe Vereine, Naturforschenden Gesellschaft and the Bienen wirthschaftlichen Vereine of Altenburg. Vol. XVIII, Parts 1 and 2, 1867. From the Societies.
- Mittheilungen aus dem Osterlande, gemeinschaftlich herausgegeben von Kunst und Handwerks-Vereine, von der Naturforschenden Gesellschaft und vom Landwirthschaftlichen Vereine zu Altenburg. Vols. 1—13. 1837—1857. From the Society.
- Augsburg. Neunzehnter Bericht des Naturhistorischen Vereins in Augsburg, 1867. From the Society.
- Berlin. Archiv für Naturgeschichte. Herausgegeben von Dr. F. H. Troschel. 32er Jahrg, 6es Heft, to 34er Jahrg, 1es Heft. From the Editor.
- Zeitschrift für die Gesammten Naturwissenschaften. Herausgegeben von dem Naturw. Vereine für Sachsen und Thüringen in Halle. 29er, 30er und 31er Banden. From the Society.
- Zeitschrift der Deutschen geologischen Gesellschaft. XIX Band, 2 Heft, to XX Band, 2 Heft. From the Society.
- Physikalische Abhandlungen der K. Akademie der Wissenschaften zu Berlin aus dem Jahre 1866. Mathematische Abhandlungen aus dem Jahre 1866—1867. From the Society.
- Monatsbericht der K. P. Akademie der Wissenschaften zu Berlin. Aug. 1867, to Juli, 1868. From the Society.
- Sitzungs-Berichte der Gesellschaft Naturforschender Freunde zu Berlin im Jahre 1866—1867. From the Society.
- Wochenschrift des Vereines zur Beförderung des Gartenbaues in den Königl. Preussischen Staaten für Gärtnerei und Pflanzenkunde. Nos. 26—52, 1867; Nos. 1—28, 1868. From the Society.

- Berliner Entomologische Zeitschrift. Herausgegeben von dem Entomologischen Vereine in Berlin. 11er Jahrg, 1867, 3es and 4es Vierteljahrsheft, und 12er Jahrg, 1es und 2es Vierteljahrsheft. From the Society.
- Bonn. Verhandlungen des Naturhistorischen Vereines der preussischen Rheinlande und Westphalens. 24er Jahrg, 1ste und 2te Hefte, 1867. From the Society.
- Braunschweig. Archiv für Anthropologie. 2er Band, 3es Heft; 3er Band, 1es and 2es Heft. From the Library Fund.
- Bremen. Abhandlungen herausgegeben vom Naturwissenschaftlichen Vereine zu Bremen. 1 Bd., III Heft, 1868. From the Society.
- Brunn. Verhandlungen des Naturforschenden Vereines in Brunn. Vol. 5, 1866, 1867. From the Society.
- Budan. A Magyar Tudom. Akademia Eökonnyvei. 1835—1862. 8 Vols., 4to. From the Royal Hungarian Academy of Science.
- Cassel. Journal für Ornithologie. Herausgegeben von Dr. Jean Cabanis. Heft V and VI, XV Jahrg., and Heft I—III, 16 Jahrg., 1867. From the Wilson Fund.
- Malakozoologische Blätter. Herausgegeben von Dr. Louis Pfeiffer. 15 Band, 1—5 Bog, and pp. 145 to 224. From the Wilson Fund.
- Danzig. Schriften der Naturforschenden Gesellschaft in Danzig, 1868. From the Society.
- Darmstadt. Notizblatt des Vereines für Erdkunde und Verwandte Wissenschaften zu Darmstadt. III Folge, V Heft, 1866. From the Society.
- Dresden. Sitzungs-Berichte der Naturwissenschaftlichen Gesellschaft Isis in Dresden. Jahrgang 1867, Nos. 4 to 12; 1868, Nos. 1—6. From the Society.
- Verhandlungen der Kaiserlichen Leopoldino-Carolinischen deutschen Akademie der Naturforscher. 33er Band, 1867. From the Society.
- Frankfurt-am-main. Der Zoologische Garten. VIII Jahrg. 1867, No. 7, to 1868, No. 6. From the Editor.
- Abhandlungen, herausgegeben von der Senckenbergischen Naturforschenden Gesellschaft. 6 Bandes, 3 and 4 Heft. 1866—67. From the Society.
- Jahresbericht über die Verwaltung des Medicinalwesens. Herausgegeben von dem Aerztlichen Verein. VIII Jahrg., 1864—1867. From the Society.
- Freiburg, I. B. Berichte über die Verhandlungen der Naturforschenden Gesellschaft zu Freiburg I B. Band IV, Heft V, 1867. From the Society.
- Görlitz. Abhandlungen der Naturhistorischen Gesellschaft zu Görlitz. 13er Band, 1868. From the Society.
- Gotha. Mittheilungen aus Justus Perthes Geographischer Anstalt. XI, 1867, to IX, 1868. Ergänzungsheft, Nos. 22 and 23. From the Library Fund.
- Göttingen. Nachrichten von der K. Gesellschaft der Wissenschaften und der Georg-Augusts-Universität aus dem Jahre 1867. From the Society.
- Hannover. Funfzehnter, Sechzehnter und Siebenzehnter Jahresbericht der Naturhistorischen Gesellschaft zu Hannover, 1867. From the Society.
- Jena. Entomologisches Archiv. Herausgegeben von Dr. Theo. Thon. Erster Band, Erstes bis 4es Heft. 2er Band, 1es Heft. 1827—1829. From the Library Fund.
- Kiel. Zoologisches Magazin. Herausgegeben von Dr. C. R. W. Wiedeman. Band 1 and Band 2, Stück 1. Kiel, 1817, and Altona, 1823. From the Library Fund.
- Königsberg. Schriften der K. Physicalish-Ökonomischen Gesellschaft zu Königsberg. 6er Jahrgang, 1865, 1 and 2 Abth., 7er Abth., 1866, 1 and 2 Abth. From the Society.
- Leipzig. Zeitschrift für Wissenschaftliche Zoologie, herausgegeben von Carl T. v. Siebold und Albert Kölliker. 18er Band, 1es Heft to 3es Heft, 1868. Namen Register über Band, I—XV, 1868.
- Archiv für Anatomie, Physiologie und Wissenschaftliche Medecin. Herausgegeben von Drs. Reichert und Bois Reymond. 1867, Heft 5, to 1868, Heft 3. From the Library Fund.

- Jenaische Zeitschrift für Medecin und Naturwissenschaft herausgegeben von der Medicinisch-naturwissenschaftlichen Gesellschaft zu Jena. 3er Band, 4es Heft, 1867. From the Society.
- Berichte über die Verhandlungen der k. s. Gesellschaft der Wissenschaften zu Leipzig; Mathematisch-Physische Classe, 1866, Nos. IV and V, 1867, Nos. I and II, 1867. From the Society.
- Des VIII Bandes der Abhandlungen der Math.-Phys.-Classe der k. s. Gesell. der Wissen. Nos. IV and V. Leipzig, 1867. From the Society.
- Linz. Sechszundzwanzigster Bericht über das Museum Francisco-Carolinum. 1866. From the Museum.
- Lund. Acta Universitatis Lundensis, 1865. Four parts, 1865—66. From the University.
- Mannheimer. Dreiunddreissigster Jahresbericht des Mannheimer Vereins für Naturkunde, 1867. From the Society.
- Munich. Annalen der Königlichen Sternwarte bei München. Vols. XV and XVI, 1867. From the Society.
- Abhandlungen der Mathematisch Physikalischen Classe der K. B. Akademie der Wissenschaften. Zehnten Bandes, 1 ste Abth. Historischen Classe. 9en Bandes, 3e Abth. 1866. From the Society.
- Sitzungsberichte der K. B. Akademie der Wissenschaften zu München. 1866, II, Heft II, to 1867, II, Heft II. München 1866—67. From the Society.
- Neubrandenburg. Archiv des Vereins der Freunde der Naturgeschichte in Meklenburg. 21 Jahrg., 1868. From the Society.
- Offenbach, A. M. Achter Band des Offenbacher Vereins für Naturkunde über seine Thätigkeit vom 31 Mai 1866, bis 12 Mai, 1867. From the Society.
- Pest. A. Magyar Tudományok Akademia Jegyzokonyvei. 1863—4—5. From the Royal Hungarian Academy of Science.
- Magyar Akademiai Ertesito. 1859—1865. From the Royal Hungarian Academy of Science.
- Mathematikai es Termeszettudományi Köszlemenek vonatkozolag v hazai viskonyokra I, II, III, Kotet, 1861—5. From the Royal Hungarian Academy of Science.
- M. Tudom. Akademiai Almanach 1864—5—6. From the Royal Hungarian Academy of Science.
- Prag. Sitzungsberichte der K. B. Gesellschaft der Wissenschaften in Prag 1867. Jan.—Dec. From the Society.
- Abhandlungen der K. B. Gesellschaft der Wissenschaften vom Jahre 1867, 6ste Folge 1er Band, 1868. From the Society.
- Regensburg. Correspondenz-Blatt des Zool.-Mineralogischen Vereins in Regensburg. 21st year. Verzeichniss der Sammlungen des Zool. Mineral. Vereins in Regensburg, 1867. Both from the Society.
- Flora oder allgemeine botanische Zeitung. Published by the Royal Bavarian Botanical Society of Regensburg. New Series, vol. 25, 1867. From the Society.
- Stettin. Entomologische Zeitung. Herausgegeben von dem Entomologischen Vereine zu Stettin. 28er Jahrg., 1867. From the Society.
- Stuttgart. Neues Jahrbuch für Mineralogie, Geologie und Paläontologie. Jahrg., 1867, 6es Heft, to 1858, 5es Heft. From the Editors.
- Jahreshefte des Vereins für vaterländische Naturkunde in Württemberg. 23er Jahrg., 1867. From the Society.
- Württembergische Naturwissenschaftliche Jahresheft; 24er Jahrg., 1es und 2es Heft, 1868. From the Editors.
- Wien. Sitzungsberichte der K. Akademie der Wissenschaften. Mathematisch-Naturwissenschaftliche Classe, 54er Band, V Heft, 1 and 2 Abth, to 56er Band, 5 Heft, 2e Abth. From the Society.
- Denkschriften der K. Akademie der Wissenschaften, Mathematisch Naturwissenschaftliche Classe, 26er und 27er Banden, 1867. From the Society.

- Jahrbuch der K. K. Geologischen Reichsanstalt, Jahrg. 1867. 17 Band. Nos. 2—4; 1868, Nos. 1—2. From the Society.
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 Bulletins de l'Academie Royale des Sciences, des Lettres et des Beaux-Arts de Belgique. 36me Année, 2me Ser., T. XXIV, 1867. From the Academy.
 Memoires Couronnés et Autres Memoires publiés par l'Academie Royale des Sciences, &c., de Beligues. Collection in 8vo. Tomes 19 and 20. Quarto, Tome 33, 1868. From the Society.
 Louvain. Annuaire de l'Université Catholique de Louvain, 1868. 32e Année. From the Society.
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INDEX TO GENERA.

| | | | |
|-------------------------|-------------------|---------------------|---------------|
| Ablepharus..... | 284 | Anolis..... | 97, 507, 312 |
| Accipiter..... | 82, 149 | Anomalopus..... | 284 |
| Acer..... | 140 | Anopthalmus..... | 86 |
| Acontias..... | 284 | Antennaria..... | 153 |
| Acrantus..... | 284 | Anthus..... | 82, 149 |
| Acris..... | 282 | Antrostomus..... | 149 |
| Actiturus..... | 150 | Anura..... | 254 |
| Actinocrinus..... | 326 | Aprasia..... | 284 |
| Acupalpus..... | 373 | Arctica..... | 3 |
| Adocus..... | 235 | Aquila..... | 82 |
| Aegialitis..... | 84, 150 | Arca..... | 94 |
| Agelacrinites..... | 357 | Archæopteryx..... | 269 |
| Agalychnis..... | 246, 282 | Archegosaurus..... | 210 |
| Agama..... | 283 | Arctomys..... | 298 |
| Agaphelus..... | 159, 193, 223 | Ardea..... | 150 |
| Agelaius..... | 84 | Arvicola..... | 2 |
| Agonoderus..... | 373 | Ascoceras..... | 287 |
| Alca..... | 3, 51 | Aspidonectes..... | 298 |
| Alces..... | 298 | Aspreto..... | 286 |
| Alligator..... | 210 | Ateles..... | 289 |
| Allium..... | 170 | Atelopus..... | 116 |
| Alloprosallocrinus..... | 352 | Athene..... | 149 |
| Alytes..... | 270 | Atretium..... | 309 |
| Alsophis..... | 312 | Atthis..... | 82 |
| Amblyrhiza..... | 313 | Aublysodon..... | 198 |
| Amblystoma..... | 247, 276, 287 | Auk..... | 274 |
| Ameiva..... | 99, 127, 275, 284 | Aulastomum..... | 229 |
| Amia..... | 294 | Auriparus..... | 83 |
| Amiurus..... | 271 | Axis..... | 247 |
| Ammodytes..... | 228 | | |
| Ammonites..... | 177, 287 | Baculites..... | 286 |
| Ampelis..... | 149 | Balæna..... | 159, 233 |
| Amphibamus..... | 210 | Balænoptera..... | 159, 192, 222 |
| Amphiglossus..... | 284 | Baphetes..... | 221 |
| Amphisbæna..... | 101, 307 | Baridius..... | 361 |
| Amphoracrinus..... | 347 | Barycrinus..... | 338 |
| Anchippodus..... | 232 | Basiliscus..... | 97, 282 |
| Anchippus..... | 231 | Bathygnathus..... | 199, 241 |
| Anchitherium..... | 231, 248 | Batocrinus..... | 349 |
| Anculosa..... | 153 | Batrachoseps..... | 276 |
| Ancyloceras..... | 287 | Batrachyla..... | 291 |
| Andrias..... | 298 | Beluga..... | 250 |
| Andromeda..... | 154 | Bernicla..... | 84 |
| Andropithecus..... | 286 | Bidens..... | 275 |
| Anelytrops..... | 284 | Blastocerus..... | 247 |
| Anguis..... | 284 | Blepharactisis..... | 284 |
| Anisoterma..... | 284 | Boa..... | 101 |
| Anodonta..... | 94, 146, 150 | Bombinator..... | 270 |

| | | | |
|----------------------|---------------|---------------------|----------|
| Borborocætes..... | 250 | Cetophis..... | 184 |
| Bos..... | 298 | Cerorhina..... | 7 |
| Brachydectes..... | 214, 215 | Centrarchus..... | 274 |
| Brachylophus..... | 283 | Chalcis..... | 284 |
| Brachymeles..... | 284 | Chamæleo..... | 316 |
| Brachyrhamphus..... | 6, 60 | Chamæsauro..... | 284 |
| Brachypus..... | 284 | Chelomeles..... | 284 |
| Brachyteles..... | 286 | Chelydra..... | 96, 298 |
| Brachymerus..... | 291 | Chelys..... | 289 |
| Brachyurus..... | 286 | Chenalopex..... | 3, 8 |
| Bradycellus..... | 379 | Chiamela..... | 284 |
| Brevoortia..... | 173 | Chilabothrus..... | 312 |
| Brimosaurus..... | 92 | Chilomeniscus..... | 289 |
| Brodiaea..... | 172 | Chimerina..... | 6 |
| Bronchocela..... | 283 | Chionactis..... | 289 |
| Bubo..... | 149 | Chiroleptes..... | 250 |
| Bufo..... | 115, 138, 250 | Chiromantis..... | 272 |
| Buteo..... | 149 | Chlorogalum..... | 173 |
| Cæcilia..... | 118, 209, 254 | Chondestes..... | 83, 149 |
| Cætia..... | 284 | Chonespondylus..... | 178 |
| Calamospiza..... | 83, 150 | Chordeiles..... | 82, 149 |
| Calochortus..... | 167 | Chrysomitris..... | 83, 149 |
| Callidryas..... | 91 | Cicigna..... | 284 |
| Callipepla..... | 150 | Cimoliasaurus..... | 92, 181 |
| Calliprora..... | 172 | Cinclidium..... | 111 |
| Callula..... | 251 | Cinnamomum..... | 148 |
| Calotes..... | 283 | Cinosternum..... | 282 |
| Calypsocephalus..... | 250 | Cirrochroa..... | 89 |
| Cardinalis..... | 84 | Cistudo..... | 119, 282 |
| Camassia..... | 170 | Cladobates..... | 285 |
| Cambala..... | 86 | Claudius..... | 119 |
| Campsodactylus..... | 284 | Clethra..... | 154 |
| Campylorhynchus..... | 83, 149 | Clidaates..... | 181, 233 |
| Cinclidium..... | 274 | Cnemidophorus..... | 284 |
| Canis..... | 298 | Coccygnus..... | 325 |
| Cardinalis..... | 150 | Coccygus..... | 149 |
| Cariacus..... | 247 | Coelosaurus..... | 241 |
| Carpodacus..... | 83 | Collyrio..... | 149 |
| Cassina..... | 281 | Colobus..... | 286 |
| Castor..... | 298 | Colophrys..... | 130 |
| Cataractes..... | 3, 8 | Colostethus..... | 137 |
| Cathartes..... | 82 | Colymbus..... | 4, 12 |
| Catillocrinus..... | 343 | Comatula..... | 325 |
| Catostoma..... | 131, 189 | Compsognathus..... | 269 |
| Celestus..... | 123, 273, 284 | Clintonia..... | 174 |
| Centemodon..... | 221 | Coniophanes..... | 104, 308 |
| Centropyx..... | 98, 119, 284 | Conophis..... | 308 |
| Centrotelma..... | 274 | Conosaurops..... | 202 |
| Centurus..... | 82, 149 | Conosaurus..... | 200 |
| Cephalanthus..... | 184 | Contia..... | 289 |
| Ceraterpeton..... | 275 | Contopus..... | 149 |
| Ceratoblepharum..... | 7 | Coranus..... | 277 |
| Ceratorhyncha..... | 28, 274 | Coreopsis..... | 275 |
| Ceratophrys..... | 250 | Corvus..... | 84, 150 |
| Cercopithecus..... | 286 | Cotyle..... | 149 |
| Cercosaura..... | 284 | Crioceras..... | 287 |
| Cervus..... | 247, 298 | Crocodylus..... | 96, 179 |
| Ceryle..... | 149 | Crotalocrius..... | 325 |
| | | Crotalus..... | 298 |

| | | | |
|-----------------------|-------------------|---------------------------|---------------|
| Crotaphytus | 283 | Embernagra | 150 |
| Cryptoblepharus | 284 | Emydes | 176 |
| Cryptomeria | 181 | Emys | 119, 176, 180 |
| Cultripes | 249, 279 | Empidonax | 149 |
| Cupellæcrinus | 325 | Enneacanthus | 274 |
| Cyanospiza | 150 | Enygrus | 101 |
| Cyathocrinites | 336 | Eosaurus | 177 |
| Cyathocrinus | 324 | Epidalea | 250, 270 |
| Cyclodus | 284 | Epigæa | 153, 183, 301 |
| Cyclorhampus | 250 | Equus | 175, 195, 248 |
| Cyclorrhynchus | 6 | Erythrolamprus | 288 |
| Cyclura | 283 | Erythronium | 165 |
| Cymbospondylus | 178 | Eremias | 284 |
| Cynocephalus | 286 | Eremophila | 149 |
| Cynorca | 185 | Eretmocrinus | 351 |
| Cyperus | 148 | Ereunetes | 150 |
| Cyrtoceras | 286 | Eschrichtius | 191 |
| Cystignathus | 115, 281, 311 | Eucnemis | 294 |
| Dama | 247 | Eumeces | 284, 317 |
| Delma | 284 | Eupelor | 221 |
| Delphinapterus | 186, 189 | Euprepis | 284 |
| Delphinus | 197, 186 | Eusophus | 250 |
| Dendrerpeton | 210, 212, 215 | Euspiza | 150 |
| Dendrobates | 291 | Euspondylus | 99, 119 |
| Dendroeca | 83, 359 | Eutania | 134 |
| Dendroica | 149 | Evesia | 284 |
| Dermatemys | 119 | Falco | 82 |
| Desmognathus | 276 | Felis | 175, 298 |
| Diodia | 184 | Feylinia | 284 |
| Dircenna | 89 | Ficus | 148 |
| Discoglossus | 270 | Formicarius | 285 |
| Diploglossus | 284, 311, 98, 123 | Formicivora | 285 |
| Diporophora | 283 | Forsythia | 334 |
| Diprotodon | 286 | Fratercula | 3, 6, 14 |
| Dipsas | 146 | Fritillaria | 166 |
| Dineutus | 365 | Fulica | 84 |
| Dinichthys | 215 | Gaultheria | 154 |
| Dinodon | 197, 198 | Geococcyx | 82, 149 |
| Dinotherium | 250 | Geothlypis | 149, 274 |
| Didelphys | 285 | Gerrhonotus | 306 |
| Didocus | 249, 279 | Gerrhosaurus | 284 |
| Dibamus | 284 | Globocephalus | 250 |
| Dichocrinus | 343 | Glyptostrobos | 182, 275, 300 |
| Dichelostemma | 173 | Gomphobates | 281 |
| Dicotyles | 230 | Gongylus | 284 |
| Ditcyocephalus | 221 | Goniloba | 87 |
| Dolichosoma | 215 | Goniobasis | 151 |
| Doliosaurus | 283 | Goniodactylus | 97 |
| Dorycerinus | 344 | Goniasteroidocrinus | 323 |
| Draco | 282 | Gonyocephalus | 283 |
| Drepanodon | 198 | Geotriton | 313 |
| Dromicus | 103 | Grus | 150 |
| Ecleopus | 284 | Gronias | 274 |
| Elephas | 251, 292 | Guiraca | 84, 150 |
| Elaps | 109, 288, 307 | Gymnoblepharum | 7 |
| Elasmosaurus | 93, 313 | Gymnophthalmus | 284 |
| Elotherium | 177 | Gymnura | 285 |
| | | Gyretes | 365 |

| | | | |
|----------------------|-------------------------|-------------------|---------------|
| Gyrinus..... | 365 | Laelaps..... | 198, 237 |
| Gyroceras..... | 287 | Laemantus..... | 283 |
| Hadrosaurus..... | 199 | Lagomys..... | 2 |
| Halobates..... | 277 | Lagothrix..... | 286 |
| Hamites..... | 287 | Lanius..... | 285 |
| Harpagus..... | 429 | Larix..... | 181 |
| Harpophynchus..... | 83, 149 | Latonia..... | 270 |
| Heliconius..... | 91 | Lepidosteus..... | 254 |
| Helicops..... | 308 | Lepidosiren..... | 254 |
| Helminthophaga..... | 149 | Leptictis..... | 315 |
| Hemidactylus..... | 311, 320 | Lepidosoma..... | 284 |
| Hemimantis..... | 281 | Leptepeton..... | 215 |
| Hemiplites..... | 274 | Leptodira..... | 109, 310 |
| Hemicystites..... | 357 | Leptognathus..... | 107, 135, 289 |
| Hemiergus..... | 284 | Leptomantis..... | 272 |
| Hemiphractus..... | 114 | Leptopelis..... | 281, 291 |
| Herpetocephalus..... | 215 | Lepus..... | 298 |
| Herpetodryas..... | 105 | Letheobia..... | 322 |
| Herpetosaura..... | 284 | Lerista..... | 284 |
| Hesperoscordium..... | 171 | Lestodon..... | 180 |
| Heteromeles..... | 284 | Lichanura..... | 2 |
| Heteroglossa..... | 247, 284 | Limnocharis..... | 137 |
| Heteropus..... | 284 | Liocephalus..... | 97, 121 |
| Himantodes..... | 109, 119 | Liolepis..... | 283 |
| Hinulia..... | 284 | Liophis..... | 102, 307 |
| Hiplocercus..... | 283 | Lithasia..... | 153 |
| Hirudo..... | 229 | Lithodytes..... | 115 |
| Holcosus..... | 306 | Lilium..... | 166 |
| Hoplobatrachus..... | 281 | Lituites..... | 287 |
| Hoplocetus..... | 196 | Liurus..... | 320 |
| Homo..... | 287 | Lomvia..... | 3, 7, 74 |
| Hydraspis..... | 119 | Lopezia..... | 155 |
| Hyla..... | 111, 119, 281, 246, 270 | Lophiodon..... | 232 |
| Hylambates..... | 272, 271, 281 | Lophodytes..... | 85 |
| Hylella..... | 111, 246, 281, 294 | Lophophanes..... | 149 |
| Hylarpeton..... | 214 | Lophortyx..... | 84 |
| Hylobates..... | 286 | Lophura..... | 282 |
| Hylodes..... | 291 | Loxodon..... | 251 |
| Hylonomus..... | 211 | Loxopholis..... | 305 |
| Hylorana..... | 139, 271, 272, 294 | Lunda..... | 7, 25 |
| Hypotamus..... | 233 | Luzula..... | 156 |
| Hyperistius..... | 274, 281 | Lycæna..... | 87 |
| Hyperolius..... | 247, 272 | Lygophis..... | 132 |
| Hypsibates..... | 97, 283 | Lystris..... | 312 |
| Hypsibatus..... | 119 | Mabuia..... | 100 |
| Hypsiboas..... | 119 | Mabuya..... | 311 |
| Ichthyosaurus..... | 177 | Macrochelys..... | 282 |
| Icteria..... | 83 | Macacus..... | 286 |
| Icterus..... | 84, 150 | Majanthenum..... | 174 |
| Ictops..... | 316 | Mancus..... | 284 |
| Iguana..... | 97, 283 | Masticophis..... | 105, 134, 307 |
| Iguanodon..... | 199 | Mastodon..... | 175, 251 |
| Iphisa..... | 284 | Mechanitis..... | 98 |
| Ixalus..... | 247, 271 | Megalonyx..... | 175, 179 |
| Ixacanthus..... | 159, 186 | Megalochilus..... | 283 |
| Juniperus..... | 181 | Megalosaurus..... | 198, 239 |
| Lacerta..... | 284 | Megaptera..... | 193, 223 |
| | | Meleagris..... | 84 |

| | | | |
|----------------------|---------------|---------------------|---------------|
| Melonites..... | 359 | Ortyx..... | 150 |
| Molospiza..... | 83, 149 | Osmerus..... | 93 |
| Menetia..... | 284 | Osteocephalus..... | 246, 250, 270 |
| Menopoma..... | 213, 298 | Osteopygis..... | 147 |
| Mephitis..... | 298 | Ovibos..... | 298 |
| Mergulus..... | 3, 5, 10, 53 | Ovubum..... | 326 |
| Merychippus..... | 248 | Oxybelis..... | 107 |
| Merychys..... | 274 | Oxyrhopes..... | 107 |
| Microlophus..... | 97 | Oxyrrhopus..... | 288 |
| Miculia..... | 284 | | |
| Mimus..... | 149 | Palæchinus..... | 359 |
| Mitchella..... | 183 | Palæophis..... | 147, 234 |
| Mixophyes..... | 281 | Palæotherium..... | 232 |
| Mococa..... | 284 | Papilio..... | 89 |
| Molgophis..... | 215, 220 | Pariostegus..... | 211 |
| Moloch..... | 283 | Paroides..... | 149 |
| Molothrus..... | 84, 150 | Panaspis..... | 317 |
| Morethia..... | 284 | Panolopus..... | 284 |
| Mormon..... | 5 | Pelamis..... | 109 |
| Mustela..... | 315 | Pelecanus..... | 150 |
| Mycetes..... | 286 | Pellon..... | 211 |
| Myiarchus..... | 149, 82 | Pelecanoides..... | 10 |
| Myiodiocetes..... | 83, 149 | Pelobates..... | 249, 279, 250 |
| Myoictis..... | 285 | Pelomedusa..... | 119 |
| Nautilus..... | 287 | Peltaphryne..... | 250, 270, 311 |
| Nectoportheus..... | 181 | Pentadactylus..... | 320 |
| Necturus..... | 208, 247, 276 | Pentalophodon..... | 251 |
| Neotoma..... | 86 | Pentremites..... | 356 |
| Nessia..... | 284 | Peropus..... | 319 |
| Notopholis..... | 284 | Perosuchus..... | 203 |
| Nototrema..... | 281 | Peucæa..... | 149 |
| Ninia..... | 101 | Phænopepla..... | 83 |
| Nipterocrinus..... | 341 | Phaleris..... | 6 |
| Nyctherodius..... | 150 | Phimothyra..... | 310 |
| | | Phractops..... | 250 |
| Odontostomum..... | 174 | Phragmoceras..... | 286 |
| Oedura..... | 318 | Phrynocephalus..... | 283 |
| Oestocephalus..... | 215, 218 | Phrynosoma..... | 283 |
| Oldenlandia..... | 184 | Phyllobates..... | 137 |
| Oligoporus..... | 358 | Phyllodactylus..... | 96, 137 |
| Olisthenes..... | 107, 119 | Physignathus..... | 283 |
| Ombria..... | 6 | Picus..... | 149 |
| Oncocephalus..... | 277 | Pinckneya..... | 184 |
| Opheodes..... | 284 | Pinguinus..... | 5, 16 |
| Opheomorphus..... | 102, 289, 307 | Pinus..... | 182, 301 |
| Opheomorus..... | 284 | Pipa..... | 289 |
| Opheosaurus..... | 284 | Pipra..... | 439 |
| Ophibolus..... | 288 | Pipilo..... | 84, 150 |
| Ophiderpeton..... | 215 | Pithecopsis..... | 112, 119 |
| Ophiognomon..... | 100, 284 | Platanus..... | 148 |
| Ophryoessa..... | 283 | Platemys..... | 298 |
| Oporornis..... | 274 | Platyceras..... | 330 |
| Otaspis..... | 312 | Platycrinus..... | 330 |
| Oreodon..... | 274 | Platysaurus..... | 284 |
| Oreoscoptes..... | 149 | Plectrophanes..... | 149 |
| Orestias..... | 294 | Plesiosaurus..... | 92 |
| Orca..... | 250 | Pletholax..... | 284 |
| Ornithorhynchus..... | 269 | Pleurosternum..... | 119 |
| Orthoceras..... | 286 | Pleurostrichus..... | 284 |

| | | | |
|------------------------------|--------------------|-------------------------------|--------------------|
| <i>Pliocercus</i> | 288 | <i>Salamandra</i> | 276 |
| <i>Physalus</i> | 222 | <i>Salpinctes</i> | 83, 149 |
| <i>Podiceps</i> | 85 | <i>Sauresia</i> | 284 |
| <i>Podocnemis</i> | 282, 298 | <i>Sauropis</i> | 284 |
| <i>Pœcilopleurum</i> | 239 | <i>Sauropoleura</i> | 215 |
| <i>Pohlia</i> | 117 | <i>Sayornis</i> | 82, 149 |
| <i>Polioptila</i> | 149 | <i>Scaphiopus</i> | 249 |
| <i>Polypodium</i> | 182 | <i>Scaphites</i> | 287 |
| <i>Pontogeneus</i> | 186 | <i>Scardafella</i> | 150 |
| <i>Populus</i> | 148 | <i>Scarus</i> | 251 |
| <i>Posodonomya</i> | 177 | <i>Scelotes</i> | 284 |
| <i>Polyborus</i> | 149 | <i>Schizostoma</i> | 153 |
| <i>Polychrus</i> | 282 | <i>Sciadopitys</i> | 182 |
| <i>Polypedates</i> | 147, 271, 272, 291 | <i>Sciurus</i> | 298 |
| <i>Polyptychodon</i> | 185 | <i>Scolecophagus</i> | 150 |
| <i>Poœctes</i> | 83 | <i>Scolecophis</i> | 289 |
| <i>Poospiza</i> | 83, 149 | <i>Scytotis</i> | 246, 250, 270 |
| <i>Poteriocrinus</i> | 336 | <i>Semnopithecus</i> | 286 |
| <i>Proctotretus</i> | 120, 283 | <i>Sepomorphus</i> | 284 |
| <i>Procyon</i> | 298 | <i>Seps</i> | 284 |
| <i>Priscodelphinus</i> | 156, 187 | <i>Sepsina</i> | 284, 318 |
| <i>Proscartes</i> | 174 | <i>Spatha</i> | 94 |
| <i>Prostemma</i> | 277 | <i>Sialia</i> | 82, 149 |
| <i>Prostherapis</i> .. | 137 | <i>Siaphus</i> | 284 |
| <i>Proteus</i> | 254 | <i>Sibbaldius</i> | 193, 222 |
| <i>Pseudis</i> | 281 | <i>Simia</i> | 286 |
| <i>Pseudopus</i> | 284 | <i>Simorhynchus</i> | 7, 34 |
| <i>Pseudotremia</i> | 86 | <i>Siphonops</i> | 118 |
| <i>Ptenopus</i> | 320 | <i>Smilacina</i> | 174 |
| <i>Ptychocerus</i> | 287 | <i>Sonora</i> | 289 |
| <i>Ptychodus</i> | 205 | <i>Sorex</i> | 298 |
| <i>Ptychoramphus</i> | 7, 52 | <i>Soridia</i> | 284 |
| <i>Pygopodes</i> | 10 | <i>Spea</i> | 249, 269 |
| <i>Pygopus</i> | 284 | <i>Spelerpes</i> | 247, 313 |
| <i>Pyrauga</i> | 83, 149 | <i>Spermacoe</i> | 184 |
| <i>Pyrgus</i> | 87, 90 | <i>Sphenocephalus</i> ... | 284 |
| <i>Pyrocephalus</i> | 82 | <i>Sphenops</i> | 284 |
| <i>Pyrhuloxia</i> | 84, 150 | <i>Spheniscus</i> | 3 |
| <i>Pyrrhopyga</i> | 90 | <i>Sphyræna</i> | 93 |
| <i>Pyxicephalus</i> | 281 | <i>Spilotes</i> | 105 |
| <i>Querquedula</i> | 84 | <i>Spizella</i> | 83 |
| <i>Quiscalus</i> | 150, 360 | <i>Stauris</i> | 247, 272 |
| <i>Rana</i> | 117, 119, 246 | <i>Stellio</i> | 283 |
| <i>Ranula</i> | 117, 119, 246 | <i>Sternotherus</i> | 119, 282 |
| <i>Regulus</i> | 149 | <i>Stegodon</i> | 251, 250 |
| <i>Retinospora</i> | 182 | <i>Streptopus</i> | 174, 376 |
| <i>Rhabdosoma</i> | 102, 288, 307 | <i>Sturnella</i> | 84, 150 |
| <i>Rhabdosteus</i> | 186 | <i>Subertia</i> | 171 |
| <i>Rhacophorus</i> | 272, 247, 271, 291 | <i>Sylvia</i> | 285 |
| <i>Rhadina</i> | 104, 132 | <i>Symphynota</i> | 146 |
| <i>Rhamphocœnus</i> | 285 | <i>Synbathocrinus</i> | 323 |
| <i>Rhinoceros</i> | 177 | <i>Synthliboramphus</i> | 6, 55 |
| <i>Rhodona</i> | 284 | <i>Tyloramphus</i> | 7 |
| <i>Rhynchoecygu</i> | 429 | <i>Typhlops</i> | 119, 128, 101, 312 |
| <i>Ristella</i> | 284 | <i>Typhlosaurus</i> | 284 |
| <i>Rusa</i> | 247 | <i>Tyrannus</i> | 149 |
| <i>Sagmatorrhina</i> | 7, 31, 274 | <i>Turdus</i> | 82, 149, 285 |
| | | <i>Turritiles</i> | 287 |

| | | | |
|----------------------------------|---------------|----------------------|-------------------|
| Tachymenis | 104 | Triquetra..... | 94 |
| Tachyphonus..... | 360 | Trochilus..... | 82 |
| Tantilla..... | 102 | Trochocerus..... | 287 |
| Taxodium.. | 182, 275, 300 | Troglodytes..... | 285 |
| Teius | 99, 119 | Troostocrinus | 356 |
| Teleuraspis..... | 110, 119 | Tropidonotus | 255, 319 |
| Testudo..... | 96, 119, 179 | Trypheropsis..... | 117, 271, 272 |
| Tetradactylus | 284 | Trypanostoma | 152 |
| Thecacampsa..... | 313 | | |
| Thecadactylus | 97 | Ungalia..... | 128 |
| Thamnophilus | 285, 361 | Unio..... | 94, 143, 150, 160 |
| Thrasops..... | 106, 309, 322 | Uria..... | 3, 9, 67 |
| Thryothorus..... | 149 | Urocordylus | 215 |
| Thylacoleo..... | 285 | Uromastix | 283 |
| Thyridopteryx | 278 | Ursus..... | 298 |
| Thuja..... | 181 | Utamania | 5, 11, 14, 18 |
| Thujopsis..... | 181 | | |
| Tiaris | 283 | Vastres | 294 |
| Tinnunculus..... | 149 | Velia | 277 |
| Titanotherium..... | 233 | Vireo..... | 83, 149 |
| Tomodon..... | 202 | | |
| Tomopterna..... | 138, 281 | Wisteria..... | 314 |
| Toxoceras..... | 286 | | |
| Trachodon..... | 199 | Xanthocephalus | 84, 150 |
| Trachyboa | 101, 119 | Xenodon..... | 133, 289 |
| Trachycephalus... 250, 245, 270, | 282 | Xiphosoma..... | 101 |
| Tretioscincus..... | 284 | | |
| Tricelocrinus..... | 356 | Yucca..... | 167 |
| Trilophodon | 251 | | |
| Tringa..... | 150 | Zenaidura | 150 |
| Trigonocephalus | 110 | Zenglodon | 186 |
| Tringites..... | 150 | Zonotrichia | 83, 430 |
| Tritelsia..... | 171 | | |

GENERAL INDEX.

- Allen, Harrison, Resignation as Corresponding Secretary, 85.
Amendment to By-Laws, 160.
- Barton, Isaac, Announcement of death of, 142.
- Brewster, Sir David, Announcement of death of, 91.
- Butcher, H. B., List of Birds collected at Laredo, Texas, in 1866 and 1867, 148.
- Committees for 1868, 85.
- Cope, Edw. D., Observations on vertebrata from Lower California and Nevada, 2; Election as Corresponding Secretary, 85; Observations on the living inhabitants of caves in South-western Virginia, 85; Remarks on a new Enaliosaurian, *Elasmosaurus platyrus*, 92; An examination of the Reptilia and Batrachia obtained by the Orton Expedition to Equador and the Upper Amazon, with notes on other species, 96; On the characters of a new genus of Cheloniidæ, 147; On the vertebræ of a serpent from the green sand of New Jersey, 147; On the fresh-water origin of certain deposits in west New Jersey, 157; On extinct Cetacea from the Miocene bed of Maryland, 159; On new species of extinct Reptiles, 181; Second contribution to the history of the vertebrata of the Miocene Period of the United States, 184; On the Crocodilian genus *Perosuchus*, 203; Synopsis of the Extinct Batrachia of North America, 208; On *Agaphelus*, a genus of toothless Cetacea, 221; Sixth contribution to the Herpetology of Tropical America, 305; Remarks on extinct Reptiles, 313; Observations on Reptiles of the Old World, Art. II, 316; On some Cretaceous Reptilia, 233; On the Origin of Genera, 242.
- Correspondence for 1868, 394.
- Coues, Elliott, A Monograph of the Alcidiæ, 2; List of Birds collected in Southern Arizona, by Dr. E. Palmer, with remarks, 81.
- De Serres, Marcel, Announcement of death of, 87.
- Donations to Library, 400.
- Donations to Museum, 396.
- Earp, Thos., Announcement of death of, 93.
- Election of Officers for 1869, 392.
- Elections during 1868, 393.
- Gabb, W. M., On Kitchen Middens near San Francisco, 182; On Fossils from the Amazon Valley, 183.
- Genth, Dr., Remarks on Tin ore from Missouri, 142; On Cupriferous ores in Texas, 227.
- Gilliams, Jac., Announcement of death of, 86.
- Grubb, Edw. B., Announcement of death of, 1.
- Hagedorn, C. F., Announcement of death of, 93.
- Hawkins, B. Waterhouse, Proposition to erect skeleton of *Hadrosaurus*, 204; Resolution of thanks to, 304.
- Lawrence, Geo. N., Description of seven new species of American Birds from various localities, with a note on *Zonotrichia melanotis*, 359.
- Lea, I., Description of nine new species of Unionidæ from Lake Nicaragua, Central America, 94; Description of sixteen new species of the genus *Unio* of the United States, 143; Notes on some singular forms of Chinese species of *Unio*, 145; De-

- scription of four new species of exotic Unionidæ, 150; Descriptions of seven new species of Unio from North Carolina, 160; Descriptions of two new species of Unionidæ from Equador, 161; Descriptions of Unionidæ from the Lower Cretaceous Formation of New Jersey, 162.
- LeConte, J. L., Analytical table of the species of Baridius inhabiting the United States, 361; The Gyrinidæ of America, north of Mexico, 365; Notes on the species of Agonoderus, Bradycellus and Stenolophus, inhabiting America north of Mexico, 373.
- Leidy, Jos., Remarks on Sombrero Guano, 156; Notice of some vertebrate remains from Harden Co, Texas, 174; Indications of an Elotherium in California, 177; Notice of some Reptilian Remains from Nevada, 177; Notice of some Vertebrate Remains from the West Indian Islands, 178; Notice of some remains of Horses, 195; Notice of some extinct Cetaceans, 196; Remarks on a jaw fragment of Megalosaurus, 197; Remarks on Conosaurus of Gibbes, 200; Extinct Mammalia of Dakota and Nebraska, including an account of some allied forms from other localities, together with a synopsis of the Mammalian Remains of North America, 205; Notice of American species of Ptychodus, 205; On the food of the Shad, 228; Notice of some American Leeches, 229; Notice of some remains of Extinct Pachyderms, 230; On supposed Coprolites from the Huronian slates of Minnesota, 302; On the iridescence of Opals, 303; On asterism in Mica, 313; On photograph of fossil bones from Topeka, Kansas, 315; Notice of some remains of extinct Insectivora, from Dakota, 315.
- Lesquereux, Leo, On the fossil plants of the coal formation of the southwest, 147.
- Lyman, Benj. Smith, Remarks on a bent Marble Stone, 91.
- McCall, Gen. Geo. A., Announcement of death of, 87.
- Meehan, Thos., On the leaves of Conifera, 181; Mitchella repens, L, a diœcious plant, 183; Sexual Law in Acer dasycarpum Ehrb, 140; Variations in Epigæa repens, 153; Monœcism in Luzula campestris, 156; Variations in Taxodium and Pinus, 300; On seed-vessels of Wisteria sinensis, 314; On the seed vessels of Forsythia, 334.
- Meek, F. B. and A. H. Worthen, Notes on some points in the structure and habits of the Palæozoic Crinoidea, 323; Remarks on some types of Carboniferous Crinoidea, with descriptions of New Genera and species of the same, and of one Echinoid, 335.
- Newkirk, Matthew, Announcement of death of, 159.
- Norris, Thaddeus, Remarks on the new species of Osmerus, 93.
- Rand, Theo. D., On a new Mineral in Cryolite, 142.
- Reakirt, Tryon, Description of some new species of Diurnal Lepidoptera. Series III, 87.
- Report of Librarian, 385.
- Report of Recording Secretary, 387.
- Report of Committee on Herpetology and Ichthyology, 387.
- Report of Recorder of Conchological Section, 388.
- Report of Secretary of Conchological Section, 389.
- Report of Conservator of Conchological Section, 390.
- Report of Librarian of Conchological Section, 391.
- Report of Curators, 383.
- Stevens, R. P., Remarks on the Geology and Mineralogy of Venezuela, 303.
- Turner, Theophilus H., Resolution thanks to, 314.
- Wagner, Tobias, Announcement of death of, 87.
- Wells, Wm. A., On the spores of Polypodium vulgare, 182.
- Wood, A., A sketch of the Natural Order Liliaceæ, 165.
- Wright, J. A., Vote of thanks to, 93.

Description of Seven New Species of AMERICAN BIRDS from various localities, with a note on *Zonotrichia melanotis*.

BY GEO. N. LAWRENCE.

[Continued from page 359.]*

5. *RYNCHOCTYLUS MARGINATUS*.

Front, top of head and hind neck dull plumbeous; back, rump, smaller wing coverts and upper tail coverts of a clear olive green; tail blackish brown with edges the color of the back; larger wing coverts and quills black, the primaries narrowly edged with yellow, the other quill feathers and the larger wing coverts broadly margined with clear light yellow; under wing coverts yellow; chin, throat and upper part of breast gray; middle and lower part of abdomen and under tail coverts light yellow; sides olivaceous gray; upper mandible black, the under whitish, clouded with brown; "irides brown;" tarsi and toes light brown.

Length (fresh) $5\frac{1}{2}$ in.; wing 2 1-16th; tail 2; bill scant $\frac{1}{2}$; tarsi 9-16ths.

Habitat.—Panama. Lion Hill, near Aspinwall. Male and female alike. Types in my collection.

Remarks.—In my Catalogue of Birds from New Granada (Annals of Lyc. of Nat. Hist. N. Y., Vol. vii, p. 473) this species is referred to *R. sulphurescens*, Spix. I have always been impressed with a doubt of its correctness, and only during the past summer was I enabled to make comparison with undoubted specimens of *R. sulphurescens* from Brazil. They differ in the Brazilian bird being larger, with the head less plumbeous, the yellow of the under parts of a deeper color and more extended, the throat only being gray, and the under mandible of a much clearer color.

It differs from *R. cinereiceps*, Scl., which at first sight it much resembles, in being smaller and of a darker green, not inclining to yellowish, as in that species. It may be readily known by the broad yellow margins on the wing coverts and quills. In this last character it is most like *R. sulphurescens*, but the markings are paler and more conspicuous than in the specimens of that species which I examined.

6. *PIPIRA*? *CINNAMOMEA*.

The general plumage is of a clear cinnamon color, brighter on the rump and tail, duller or somewhat brownish on the back and wing coverts, and paler on the under surface; the top of the head and occiput are of an olivaceous brown, with a concealed crest of reddish orange; the quills are liver-brown, with an edging of pale cinnamon on the outer webs; upper mandible dark brown, the under whitish at base with the end brown; tarsi and toes reddish brown.

Length 4 in.; wing $2\frac{1}{2}$; tail $1\frac{1}{2}$; bill 5-16ths; tarsi $\frac{1}{2}$.

Habitat.—The Upper Amazon. Type in my collection.

Remarks.—I have placed this species provisionally in *Pipra*, to which it most nearly assimilates, but it has the wings shorter and the tail longer, relatively, than in any other member of the genus I have been able to examine, and I know of no other species resembling it in color.

7. *HARPAGUS FASCIATUS*.

Plumage above blackish-brown, glossed with dark purple; the tail is blackish-brown, crossed above with four narrow bars of grayish-white, and ending with ashy-gray; the quills on the upper surface are umber-brown, crossed with dusky blackish bars, and on the under surface are white for two-thirds their length from the base, the remaining part ashy-gray, barred throughout with blackish-brown; the under wing coverts are buffy-white, spotted with dark-brown; each feather of the entire under surface is closely barred with white, rufous and dark brown, the rufous color prevailing most on the breast and

* This portion of the paper was inadvertently left out by the editor.

sides, less on the thighs, and scarcely showing on the middle of the abdomen; under tail coverts white; the feathers of the upper part of the throat appear to be partly white, but they are too much soiled to judge with certainty; upper mandible black, the under yellowish-white; legs dark yellow, claws black.

Length (skin) about 12 in.; wing $8\frac{1}{2}$; tail $6\frac{1}{2}$; tarsi $1\frac{1}{2}$.

Habitat.—Guatemala. Obtained from Dr. C. H. Van Patten. Type in my collection.

Remarks.—This specimen, which seems to be fully adult, makes a third species of the genus *Harpagus*, the other two being *H. bidentatus*, Lath., and *H. diodon*, Temm. The characteristic toothing of the bill is strongly developed, but it otherwise differs so entirely from the above two species in all their stages of plumage, by the broad transverse markings of its under surface, that no comparison with them is requisite.

Note on ZONOTRICHIA MELANOTIS.

This species should be placed in the genus *Hæmophila*, and much resembles in distribution of its markings, *H. ruficauda*, Bp. That species I had not seen at the time I described *Z. melanotis*. They differ in the tail of my species being liver-brown instead of rufous, and in having the tail feathers edged with whitish. In place of the decided rufous coloring of the sides, abdomen and under tail coverts of *H. ruficauda*, there is only a wash of that color in *melanotis*. The dark stripes on the crown and sides of the head are pure black; the corresponding ones in *ruficauda* are dark brown mixed with rufous. In the last named species there is a broad band across the breast, of dark ash: this part in my species has only an ashy suffusion. The smaller wing coverts of *H. ruficauda* are of an immaculate bright rufous, those of *H. melanotis* are less bright, with dark brown shaft stripes. The bill of *H. ruficauda* is larger, and in its general plumage it is the most rufous of the two species.

Mr. O. Salvin (*Ibis* 1868, p. 299) says of my species: "Possibly the same as *Hæmophila humeralis*, Cab." It apparently differs in many marked characteristics from the description given of that species.

BIOLOGICAL AND MICROSCOPICAL DEPARTMENT

OF THE

ACADEMY OF NATURAL SCIENCES.

On the evening of March 28th, 1868, a meeting of gentlemen interested in the organization of a Microscopical Society was held at the office of Dr. James Tyson, at which sixteen were present, while written or verbal communications signifying sympathy with the project were presented from at least as many more.

Dr. R. S. Kenderdine was called upon to preside and Dr. Tyson to act as Secretary. A letter from Prof. Jos. Leidy was read, urging the advantages of working under the Biological Department of the Academy of Natural Sciences. Such, or a similar plan of organization met with approval, and a committee, consisting of Drs. H. C. Wood, Jos. Leidy, Wm. Pepper, J. H. McQuillen and James Tyson, was appointed to take into consideration the propriety and feasibility of forming a *Microscopical* Department of the Academy of Natural Sciences, and to report at a meeting to be held Saturday evening, April 4th, at the same place.

April 4th, 1868.

President, R. S. KENDERDINE, M. D., in the Chair.

Seventeen gentlemen present.

The Committee appointed at the last meeting reported, "It having been strongly urged by members of the Committee and influential members of the Academy of Natural Sciences, that we should not organize a purely Microscopical Department, we consider that the objects of the meeting will be most successfully attained by forming a Department or Section to be known as The Biological and Microscopical Department of the Academy of Natural Sciences of Philadelphia, which will combine the objects of the existing Biological Department and a Microscopical Society, in a manner to be determined in accordance with Chap. XIII of the By-Laws of the Academy, On the Creation and Government of Departments."

This report was adopted and the Committee continued to carry out its report.

MEETING OF BIOLOGICAL DEPARTMENT OF THE ACADEMY.

April 16th, 1868.

Director, JOS. LEIDY, M. D., in the Chair.

Six members present.

The Director stated the object of the meeting to be to take into consideration the revival of the Biological Department of the Academy, and its union with a proposed Microscopical Department.

After some discussion, it was voted that a committee of three, including the Director, be appointed to confer with the Microscopical Society and point out the advantages to accrue from the proposed union, and afterwards to take such action in the Academy as shall be required to bring about such union. Drs. Leidy, Mitchell and J. A. Meigs were appointed.

Adjourned to meet on 1st Monday in May.

April 25th, 1868. Proposed Microscopical Society.

President, R. S. KENDERDINE, M.D., in the Chair.

Twenty-three gentlemen present.

The Committee reported that on April 18th, 1868, they met a Committee of the Biological Department of the Academy, consisting of Drs. Jos. Leidy, Dr. S. W. Mitchell and J. A. Meigs, and as the result of this conference, were empowered to offer the following propositions to the meeting, if, in accordance with the resolutions of the first meeting, it be deemed desirable to unite with the Biological Department of the Academy.

I. The name of the present Biological Department shall be changed to Biological and Microscopical Department.

II. All microscopic apparatus and preparations now owned by the Biological Department will be freely available to the new Department.

III. The extensive microscopic library of the Academy will be accessible to them, and the purchase of new books can be secured from a fund provided for the purpose.

IV. Meetings can be held in the Hall of the Academy at whatever time appears desirable to the members of the Department, except the evenings of the stated meetings of the Academy, and the order of business can be arranged as desired.

V. A motion shall be urged upon the Academy that the amount of entrance fee and the annual contribution for the first year, of new members joining the Academy for the sake of becoming members of this Department, shall be voted as an appropriation to the Department.

On motion of Dr. Wm. Pepper, it was voted that if the advantages above detailed are granted by the Academy, it is deemed desirable that the gentlemen wishing to form a Microscopical Society unite with the body known as the Biological Department of the Academy, under the title of the Biological and Microscopical Department of the Academy of Natural Sciences of Philadelphia.

It was also voted that a committee of three be appointed to carry out the resolution and to take proper steps to have those gentlemen not members of the Academy made such. The Chair appointed Prof. F. G. Smith, Drs. H. C. Wood and W. Pepper.

Adjourned until called by the officers of the Biological Department.

Biological Department, May 4th, 1868.

Vice Director, S. W. MITCHELL, M. D., in the Chair.

Three members present.

The following gentlemen, also present, members of the Academy of Natural Sciences, on complying with the By-Laws of the Academy on the subject of Departments, were also declared members:—Wm. Pepper, M. D., H. M. Bellows, M. D., F. W. Lewis, M. D., Isaac Norris, M. D., James Tyson, M. D., Harrison Allen, M. D., H. C. Wood, M. D., R. S. Kenderdine, M. D., T. C. Stellwagen, M. D., J. H. McQuillen, M. D., J. G. Hunt, M. D., C. N. Peirce, D. D. S., C. A. Kingsbury, D. D. S.

Eleven gentlemen interested in the proposed Microscopical Society, but not members of the Academy, were also present by invitation.

Dr. J. H. McQuillen exhibited a number of sections of human teeth which he had prepared, demonstrating the *interglobular spaces in dentine*, and also made some extended remarks descriptive of his investigations in this direction, which he proposes to publish in the Proceedings.

Biological Department, May 19th, 1868.

The Director, JOS. LEIDY, M. D., occupied the Chair.

Thirteen members present; eleven, not members, present by invitation.

Dr. Tyson exhibited specimens of black crystalline forms, generally rhomboidal, obtained from fecal discharges, and which presented the characters of *hæmin* crystals, as described by Virchow in "Cellular Pathology."

Dr. S. W. Mitchell having recently studied the life of the rattlesnake, remarked, with regard to the growth of their rattles, that they are produced at all times, even when the reptile has been long deprived of food, and that they are not produced one in each year of the life of the reptile, as commonly thought.

Biological Department, June 1st, 1868.

Director, JOS. LEIDY, M. D., in the Chair.

Sixteen members present, also nine gentlemen, proposed members. The following were declared members of the Department:—

Jno. Neill, M. D., T. L. Buckingham, D. D. S., R. W. Hargadine, M. D., E. L. Hewitt, D. D. S., Aug. F. Müller, M. D., Edw.

Rhoads, M. D., W. H. Trueman, D. D. S., James Truman, D. D. S., Chas. Shaeffer, M. D., Henry C. Chapman, M. D., W. W. Keen, M. D., W. Lehman Wells, M. D., T. H. Andrews, M. D., Geo. Pepper, M. D., D. Murray Cheston, M. D., Horace Williams, M. D., Herbert Norris, M. D., Chas. Bullock, W. L. McFadden, Joseph Zentmayer, W. H. Walmsley, T. W. Starr, Horace B. Hare, M. D., Prof. Robt. E. Rogers, M. D., and F. F. Maury, M. D.

The resignations of Messrs. McAllister, Atlee, Wilcocks and Ziegler were read and accepted.

Dr. J. H. McQuillen exhibited longitudinal and transverse sections, prepared by himself, illustrating the anatomy of the poison fangs of the rattlesnake. The fangs were from the head of a rattlesnake furnished to him by Dr. S. W. Mitchell.

Biological Department, June 16th, 1868.

WM. PEPPER, M. D., in the Chair.

Twenty-five members present.

Drs. J. L. LeConte, J. H. Packard and S. B. Howell were declared members of the Department.

The resignations of Mr. Constant Guillou and Drs. A. Hewson and Henry Hartshorne were read and accepted.

Dr. W. W. Keen exhibited some injected preparations mounted in sections, by Prof. Thiersch of Leipzig. Some of these were marvels of execution, more particularly as to the extent of the sections, being those of an entire kidney of a cat and rabbit, and similarly extensive tissues. They were mounted in balsam, and exhibited, for the most part vascular arrangement only.

At the election of officers this evening for the remainder of the year 1868, the following were chosen:—

Director, Wm. Pepper, M. D.

Vice Director, J. Gibbons Hunt, M. D.

Recorder, James Tyson, M. D.

Corresponding Secretary, J. H. McQuillen, M. D.

Conservator, Herbert Norris, M. D.

Treasurer, C. N. Pierce, D. D. S.

July 6th, 1868.

Director, WM. PEPPER, M. D., in the Chair.

Twenty-three members present.

Dr. H. C. Wood exhibited a section through the root of the *American mistletoe*, showing the intimate conjunction of the woody tissue of the parasite with that of its foster mother, as well as the distinctness of the two, and remarked on the fact that the green leaved phanerogamic parasite thus pierced into the region of the crude sap, while the tawny, scale leaved, such as the *beech drop*, are only capable of nourishing themselves with the elaborated sap, and that therefore they merely pierced the bark of their victim, their roots ramifying through the cambium layer.

Dr. J. G. Hunt remarked:

It is well known to botanists that in the pitcher of *Nepenthes distillatoria* there are numerous glands lining its internal surface, and extending from the extreme bottom up nearly to the middle of the pitcher. This system of glands has been described by Treviranus but never correctly figured that I am aware of. But if we examine with a common lens, the frill, or thickened edge surrounding the top of the pitcher, looking carefully along the inner and lower margin, we may detect numerous little apertures, leading into short canals, and terminating in as many large cylindrical glands which lie around the top of the pitcher like guns around a fortification. These glands lie imbedded in a parenchyma, made up almost entirely of large spiral cells, and this would seem to indicate considerable activity in their function, which, no doubt, is to pour down a multitude of trickling rills into the cavity of the pitcher. I am not aware that botanists have alluded to these glands before, and it is probable analogous ones exist in the other species of this genus.

Dr. Hunt also exhibited preparations illustrating the anatomy of *Drosera rotundifolia*, and remarked that

The glands terminating the filaments growing on the leaves are beautiful structures when rendered sufficiently transparent for observation. A spiral vessel traverses the centre of each filament and terminates at its free end in several large, elongated spiral cells. Around, and entirely enclosing this cluster of spiral cells, many columnar cells filled with granules are arranged, their long diameters pointing outwards, and a delicate epidermis envelops all. If the mature leaf be severed from the plant and placed in favorable conditions, adventitious buds will be formed on it, and thus a crop of young *Droseras* may be obtained. We have examined this plant in all its stages of growth, under lenses, and without them, and failed to detect any evidence of irritability, and while it doubtless does *catch* flies and other small objects by means of the adhesive liquid on the glands, it would seem that the conclusion drawn from this fact, namely, that the *Drosera* needs animal food *thus* for its growth, is, perhaps, premature. Has such fact ever been proved?

July 20th, 1868.

Vice-Director, J. G. HUNT, M. D., in the Chair.

Sixteen members present.

Donations.—A preparation of epithelial cancer of the larynx, presented by Dr. J. J. Woodward.

A photograph of *acarus sacchari*.

An official communication was received from the Recording Secretary of the Academy of Natural Sciences, containing an abstract of the minute of a recent meeting of the Academy, at which the following by-law was passed after the third reading.

"Art. xxi, of Chap. XIII. The Department A shall be denominated the Biological and Microscopical Department of the Academy of Natural Sciences of Philadelphia." Thus authorizing officially the new title of the Department.

BIOLOGICAL AND MICROSCOPICAL DEPARTMENT.

Aug. 3d, 1868.

MR. CHAS. BULLOCK in the Chair.

Eleven members present.

Aug. 17th, 1868.

Director, WM. PEPPER, M. D., in the Chair.

Fifteen members present.

Dr. J. Gibbons Hunt exhibited and described an improved Section instrument.

A brass tube, two inches long and three-fourths of an inch in diameter, is closed at one end; a circular brass plate two inches in diameter attached to the other end, and ground properly flat, forms the surface to guide the razor. Into this tube fits another, which is worked up or down by a screw working in a thread cut in the bottom of the outside tube. A slot cut *through the upper end of the outer tube* affords room for a lateral binding-screw, which is *attached to and carried by the inner tube*. The binding-screw presses against a moveable tongue of metal armed at the upper and inner side with minute points. On the opposite side of the inner tube are also points designed to hold an object more securely. The advantages of this improvement are obvious. It is cheap, and is peculiar in really answering the purpose for which it is made.

Cork is *unfit* for holding objects in a section instrument; some *firm* vegetable, such as a turnip or potato, for all *very delicate* preparations being far better.

Sept. 7th, 1868.

Director, WM. PEPPER, M. D., in the Chair.

Seventeen members present.

Dr. Wm. Pepper read a paper, illustrated by microscopical preparations, "On the action of phosphorous in poisonous quantities upon the animal economy."

See American Journal of the Med. Sciences, April, 1869.

George Roberts M. D., and Ferdinand A. Hassler, M. D., were chosen members of the Department.

Sept. 21st, 1868.

Director, W. PEPPER, M. D., in the Chair.

Twenty members present.

A complete set of photographs of the 19 bands of Nobert's most recent test plate, the last four showing spectral bands only, were presented by the Surgeon General U. S. Army, through Dr. J. J. Woodward.

DR. LEIDY observed that having noticed in the recent edition of Gray's Manual of Botany, the description of a species of *Wolffia*, for the first time published as occurring in the United States, he was led to seek for it in the vicinity of Philadelphia, under the impression that he had long been familiar with a plant of the kind, but without knowing its true character. He was successful in his search, having found it growing abundantly in a ditch skirting the road near the Delaware River, below the built up portion of the city. It is accompanied by a profusion of *Lemna polyrrhiza* and *L. minor*.

Dr. Leidy exhibited specimens of the plant in a glass vial and also beneath the microscope. This, the smallest and simplest of all the true flowering plants, appears to be the *Wolffia Columbiana* of Karsten, to which the United States plant of other localities has been referred in Gray's Manual. The description in the latter is very brief, and the original is not accessible in our library. The plant is larger than indicated in Gray, and may be looked upon as a variety. It was described as follows:

The frond is oval or nearly globular, uniformly bright pea-green, smooth or slightly muricate, shining. Plant floating at the surface of the water, about two-thirds submerged with the long diameter horizontal. No distinctive appearance between the upper and lower surfaces. In a state of multiplication usually observed with the new frond projecting from within one end of

the parent, of all sizes nearly, to that of the latter itself. When the new frond is separated, the parent is observed to appear truncate at the pole of separation with a cup-like concavity, surrounded by a thin hyaline margin, which is sometimes slightly everted. After the establishment of the cup, a succession of new fronds appear to be produced from it, and may be observed in different fronds in all stages of growth. The new fronds are slightly pedicellate, and the offspring of these appear to originate close to the pedicel. Size of the full grown frond from $\frac{1}{2}$ to $\frac{1}{4}$ a line in depth and breadth, with the length slightly greater.

Outer epidermis composed of hexagonal cells in outline, with an abundance of chlorophyl grains adherent to the interior surface. Cells of the margin of the cup for two or three rows twice the breadth but not more than half the depth of the others. Stomata remarkably few; not more than from two to four observed in a frond. Interior of the frond occupied with large spheroidal cells, three times the diameter of those of the epidermis. Air occupies many of the interior cellular interspaces. Towards the point of attachment of the new frond, the cells of the parent diminish in size and these contain some brownish coloring matter.

The flowers and fruit of *W. Columbiana*, as observed in Gray's Manual, have not been seen in the United States, but the fruiting plant, it is also stated, has been recently discovered by Karston, in Venezuela. No flowers or fruit were detected in the Philadelphia plant.

Dr. J. H. McQuillen performed some experiments on animals with nitrous oxide before the Department, prior to which

He remarked that every one present is no doubt aware that the recent introduction of nitrous oxide as an anæsthetic in England, has been much opposed by a number of prominent medical men there, particularly Drs. B. W. Richardson and A. E. Sansom, both of whom have devoted years to the careful study of anæsthetics, and, on account of their observations, experiments and contributions to the literature of anæsthetics, have come to be regarded "as of authority" in such matters; and their combined opposition appears to have had considerable effect upon the medical profession, judging from the comments in the medical journals, and the reports of proceedings of medical societies opposing its use; but the dental profession of England, aware of the remarkable exemption from fatality which has attended the use of nitrous oxide in America—frequently in the hands of most ignorant persons—have determined to give the agent a fair trial. The result is not an uncertain one, and before another year passes by nitrous oxide, in the hands of the progressive members of the dental profession in Great Britain, will almost entirely supersede, as in this country, the use of ether and chloroform in the extraction of teeth, and there is no reason why it should not be employed in the minor and capital operations of general surgery.

Dr. Richardson, in addition to his opposition to the use of nitrous oxide as an agent that "had caused death in the human subject" (making this assertion notwithstanding the fact that, in 100,000 cases or more in which it has been employed in America, no fatal case can justly be attributed to it as the direct cause), said at a meeting of the Medical Society of London, that "*on animals it was so fatal that, with the utmost delicacy in its use, it was a critical task thoroughly to narcotize an animal with the gas without actually destroying life. In some cases, also, animals died after recovering from the insensibility.*"

In accounting for this fatality in man and animals, nitrous oxide has been denied the possession of anæsthetic properties, and the results obtained attributed to *asphyxia*, due to "suspension of oxygenation," as in cases of death from the inhalation of the fumes of charcoal or carbonic acid gas, rather than impressions made upon the brain directly by the agent. It is somewhat singular to have such an explanation offered in connection with a substance which supplies an excess of oxygen to the blood. It is not my intention, however, this evening, to enter into the consideration of how nitrous oxide acts upon

the system; but with a view of testing the accuracy of the statement quoted which, as you will observe, was made in the most decided and emphatic manner, without the slightest limitation or reservation to repeat a series of experiments on some animals in your presence to whom I administered nitrous oxide before the members of the Odontographic Society, three weeks since.

The gas was then given as follows:

1st experiment.—A white rabbit, in good condition, was placed upon the table, held by assistants, and Barker's flexible india-rubber hood adjusted over the face of the animal, so that it could inhale the gas directly from the gum-bag. A valve in the inhaler admitted of the ingress of nitrous oxide gas to the lungs, and of the egress of the carbonic acid from them. After some little resistance, the rabbit became sensibly affected by the gas, in a minute and a quarter fell over on its side perfectly motionless, so completely narcotized that, on being held up by the ears, feet, or tail, it made no resistance, and would have been taken for dead but for slight respiration and the evident movements of the heart on applying the hand to the chest. In two minutes and ten seconds it revived, and sprang from the table to the floor, apparently unaffected by the experience it had just passed through.

2d experiment.—Another white rabbit was treated in the same manner as the first, with the exception that the gas was applied for a longer period, (1m. 20 sec.), and the animal was much slower in recovering from the effects. Several of the gentlemen, indeed, thought that life had become extinct, but five minutes after the induction of narcosis, it was running about on the floor with its companion.

3d experiment.—A kitten, about four months old—which had been suffering from the distemper, refusing solid food during the preceding five weeks, and on drinking milk almost invariably vomited it—was then treated as the other animals had been. The resistance to the inhalation of the gas was much greater on her part, and the urinary organs were so much affected that quite a profuse discharge of urine occurred. In 1 m. 30 sec. the animal was completely narcotized, and remained in an inanimate condition for 1 m. 10 sec., when it gradually revived, and appeared none the worse for the free supply of the gas.

4th experiment.—The gas was then introduced into a bell-glass receiver over a water bath, and a frog placed under the glass; but apparently owing to the rapidity with which water absorbs nitrous oxide, the animal remained there for more than half an hour unaffected by it.

5th experiment.—Another frog was placed in a wet bladder, the opening of which was tied tightly around the nozzle of the inhaler, and the gas passed into the bladder; in 3 m. 33 sec. the frog was lying on his back perfectly motionless, the translucence of the bladder affording a view of his position and condition. On untying the string and taking the animal out of the bladder, the access of fresh air revived it at once, and it jumped from the table with its usual vigor.

These experiment occupied about one hour, and some idea may be gained of the freedom with which the agent was administered to the animals by the fact that about forty gallons of gas were used up. At the close of the evening, when the meeting adjourned, the animals were perfectly comfortable.*

Mr. Chas. Bullock remarked that the impression so commonly held as to the effect of the continued inhalation of oxygen has been recently shown to be erroneous, and suggested the possibility that the varying effects might be due to allotropic states, in one of which,

* All of these animals have been under my daily supervision during the past three months, since the performance of the experiment, and none of them have manifested any discomfort, but, on the contrary, are in a perfectly healthy condition, the kitten in particular having improved so much under the remedy that, in a day or so after inhaling the gas, it partook freely of its food, and has been quite active and playful ever since.

the absorption of a larger quantity of oxygen being at times permitted, death resulted; and at other times, in an opposite state of the gas in which none was absorbed, no harm resulted.

Dr. H. C. Wood stated that he had known the administration of nitrous oxide gas to a patient suffering with uterine colic to fail to produce anæsthesia.

Richard K. Betts was elected a member of the Department.

Oct. 5th, 1868.

Director, WM. PEPPER, M. D., in the Chair.

Twenty-seven members present.

PROF. LEIDY directed attention to a specimen of a sponge which had been for many years in the Museum of the Academy, and had been presented by the late Dr. R. E. Griffith, who obtained it in the Island of Santa Cruz, W. I. It is especially interesting from its relationship with that most beautiful of all known sponges, the *Euplectella aspergillum*, and apparently also to that enigmatic body the *Hyalonema Sieboldii* of Japan. Specimens of both these were also exhibited. A beautiful one of the former, from the Philippines, presented to the Academy by Joseph Henry Craven. Several specimens of the *Hyalonema*, presented by Drs. Ruschenberger and Sinclair, consist of a twisted fasciculus or rope of long, coarse, translucent siliceous threads, partially invested with a brown verrucose membrane or bark. When the first specimen was presented to the Academy in 1860, (Pr. A. N. S. 1860, 85,) Prof. Leidy, as Curator, reported it as a part of a sponge with a parasitic polyp upon it. One of the specimens may have some significance as to the relation of the rope of spicules and its polyp covering. It has attached two shark eggs and part of the tendril-like cords of another. The tendrils clasp the rope and are also partially invested with the polyp crust. In the complete condition, the *Hyalonema* fasciculus appears always to be associated at one end with a sponge-mass. Originally described by Dr. R. E. Gray, the fasciculus was viewed as the axis of a coral of which the verrucose bark formed part, the warts constituting the polyps; and he supposed the fasciculus to grow as a parasite from the sponge, frequently seen in specimens attached to one of its extremities. This still appears to be the view of Dr. Gray, as announced in recent volumes of the Proceedings of the Zoological Society, etc.

Dr. Bowerbank views the siliceous rope, with its warty investment and the sponge mass at one end, altogether as the elements of a sponge. The warts or polyps of Dr. Gray he regards as the oscules of the sponge.

Schultze, in an elaborate memoir, (Die Hyalonemen) accompanied by beautiful plates representing the complete *Hyalonema*, as the result of his investigations, determines the sponge-mass and projecting siliceous rope to be together the elements of the sponge, and the warty investment of the rope to belong to a polyp to which he gives the name of *Polythoa fatua*. In the crusts or individual polyps he detected the arms filled with netting cells.

Brandt views the siliceous rope and its investment as a polyp, and the sponge mass at one extremity as a parasite invading, ultimately to destroy the polyp.

Lastly, among the discordant views, Ehrenburg looks upon the siliceous rope as an "artificial product of Japanese industry."

Prof. L. continued, I shall not discuss this extraordinary difference of opinions among experts, but must confess that I view most favorably the theory that the sponge-mass and the siliceous rope together constitute the sponge *Hyalonema*, while the warty crust of the rope constitutes a parasitic compound polyp, the *Polythoa fatua* of Schultze.

The sponge from Santa Cruz, in its body and projecting fasciculi of siliceous threads, reminds one of the *Hyalonema* sponge with its siliceous rope, but the structure of the threads of the former more nearly resembles those of the

anchor threads of *Euplectella*. It is evidently a different sponge from either of those just named, and may be called *Pheronema*.

The body of the sponge is oblong ovoidal, with the narrower end upward, and with one side more prominent than the other. The lower extremity is rather cylindroid and rounded truncate. The upper extremity is conical, with a truncate apex presenting a large circular orifice. This is about 4 lines in diameter and is the exit of a canal which descends in the axis of the sponge for almost half its depth, and then appears to divide into several branches. The sides of the sponge form thick dense walls to the cylindrical canal, which is of uniform diameter before its division.

In its present condition the sponge is of a light brown hue. Its surface exhibits an intricate interlacement of stellate, siliceous spiculæ, including a tissue of finer spiculæ of the same character, the whole associated by the dried remains of the softer sponge tissues. More or less fine sand, especially at the lower end of the sponge appears to be introduced as an element of structure.

From the lower end of the sponge there projects a number of distinct or separate tufts of siliceous spiculæ, looking like tufts of blonde human hair. In the specimen there are fifteen tufts projecting around two-thirds of the extremity of the sponge, but the remaining third of the extremity of the latter exhibits about ten orifices, from which as many additional tufts appear to have been extracted.

Length of the body of the sponge $4\frac{1}{2}$ inches; diameter at middle 22 lines, at lower end 15 and 17 lines, at upper end 8 lines. Length of tufts of spiculæ 2 inches. The coarser stellate spicules of the surface of the sponge in general have five rays, of which four are irregularly cruciform, while the fifth projects at a right angle to the others towards the interior of the sponge. The rays of the contiguous crosses form together a lattice work on the surface of the sponge, and the intervals are covered by the rays of the finer spiculæ which also in general have a five-rayed stellate character. The finer tissue in the interior of the sponge, seen through the lattice work of the surface, contains a multitude of spicules which differ from the others only in their minute forms. Some of the largest stellate spicules on the surface of the sponge have a stretch of three-fourths of an inch.

The spicules of the tufts projecting from the sponge are two or three inches in length and vary in diameter. They become attenuated towards both extremities, but especially that inserted into the sponge-mass. Starting from the latter, they are at first smooth, then finely tuberculate; the tubercles gradually become converted into well marked recurved prickles or hooks, and finally the spicules end in a pair of longer hooks, recalling to mind the arms of an anchor. The spicules bear a near resemblance to those at the lower extremity of *Euplectella*, but have only two instead of four hooks at the end. In the specimen but few of the spicules present the complete character as described, most of them apparently having been broken.

The object of the tufts of spicules with their recurved prickles, and anchor-like free extremities, in *Pheronema* would appear to be to maintain the position or preserve the anchorage of the sponge in its ocean home, and perhaps in the living animal they are incessantly produced as occasion may require, just as a *Mytilus* or a *Pinna* renews and attaches its threads of byssus to secure its position.

The siliceous spicules of *Pheronema* are composed, as in sponges generally, of concentric layers, and exhibited a delicate tubular axis. A spicula from one of the tufts measured as follows:—

Spread of the anchor one-tenth of a line; shank of the anchor one-thirtieth of a line; prickled portion of shaft one-fortieth of a line; shaft where thickest and without prickles one-eighteenth of a line, thinning out to the inserted end where it was not more than $1\text{--}300\text{th}$ of a line.

The species I propose to dedicate to my wife under the name of *Pheronema Annæ*.

Dr. Leidy further remarked, that if any of the members desired to examine

Euglena viridis, he had observed it in great profusion on Friday last in a ditch skirting the Delaware road below the coal oil depot, south of the built portion of the city. The water looked in the spot as if Schweinfurt green had been strewn on the surface. He also exhibited drawings of a species which appeared to be an undescribed one, and which he had several times noticed late in the spring and early summer some years ago. The drawings were made from specimens obtained in a pond near Gloucester, N. J., in May, 1858. The water of the pond was thickly coated with a ferruginous red color due to the *Euglena*. The infusorium is not of a blood-red hue, as is stated to be the case in *Euglena sanguinea*, but is of a uniform ferruginous red. Upon keeping the animalcule a few days in a glass vessel exposed to the northern light, the exterior of the contents assumed a bright green hue, and the red eye point, previously invisible, came into view, while the central mass of contents remained of the original color. The animalcules remained in this condition subsequently until they died. In motion the animalcule assumed the various forms observed in *E. viridis* and other species. It would elongate to about 1-15th of a line by the 1-75th of a line wide. In the resting condition assuming a globular form, it measured 1-37th of a line in diameter.

The head is obtuse; the mouth oblique; the tail acute, and the flagellum is about the length of the body. Generally two nucleus-like vesicles occupied the interior, besides a clearer space around the position of the eye-point.

Dr. R. W. Hargadine exhibited some beautiful crystals of hæmato-crystallin, prepared by himself after the method of Bojanowski, who takes a quantity of blood drawn from a vein, or better from the blood vessel of an animal after death, and places it from two to four days in a cool place, until the blood corpuscles begin to form a thick, dark red, or black mass. A drop of this fluid is placed on a slide, covered, and placed in a dark place for several hours, when the crystals begin to form.

Dr. Chas. H. Thomas was elected a member of the Department.

Oct. 19th, 1868.

Director, WM. PEPPER, M. D., in the Chair.

Twenty-two members present.

Dr. H. C. Wood, Jr., called the attention of the Department to the manner in which one of the plant inhabitants of the ditches below the city produces its *zoospores*. The plant in question is filamentous, and grows in great numbers attached to twigs, bits of dead grass, splinters of wood, &c., in stagnant or partial stagnant water.

At its maximum size it is very apparent to the unaided eye, and is of a dark green or even blackish color. Such large filaments are perfectly opaque and are composed of numerous cells. The base of the filament is narrowed, and at irregular intervals in its length there are very marked contractions. The younger filaments are uniform and composed of a single series of cells. The *zoospore* is of the ordinary conical form, with the usual transparent space at the smaller end, from which arise three long cilia. The living *zoospore* soon becomes attached by its pointed end to some support, its cilia withering away, and commences to elongate at the expense of its transverse diameter. At the same time it acquires a cellulose coat. After a while the cell thus formed divides transversely into two. Growth continuing, each of these cells after attaining a certain size, again divides transversely, and so the process goes on, until finally a long filament is produced, which is composed of a single series of cells placed end to end. When this filament has reached a certain stage of development, one of two things occurs, either the cells begin to divide in the direction of their length, or the production of *Zoospores* takes place. In the first instance each cell

divides into two, four, &c., cells, so that in the filament a number of cells lie side by side, and from this compound filament the large matured trichoma is formed by a continuation of growth and division. The *zoospores* are formed only in the younger fronds, these old compound trichomata appearing to be incapable of developing them. The endochrome in a cell about to produce *zoospores* divides into several more or less irregularly globular or pyriform masses. This change takes place almost simultaneously in a number of consecutive cells. The walls of the cells now undergo some alteration, whereby they become soluble in water. And as the division of the endochrome occurs first in the most distant cells of the filaments, so does also this change in the cellulose coats. Solution of the walls now takes place, the partitions between the cells disappearing, and the outer walls opening out, separating from one another. At the same time the *zoospores* begin to move uneasily, rolling on themselves, pushing forward, &c., and soon make their exit in a long stream which issues from the end of the filament.

This plant appears to be the same as that described by Kützinger under the name *Schizomeris Leiblinei*. No European observer has, however, as yet noticed the manner in which the latter produces its *zoospores*, and therefore it is impossible to be certain in the identification. If *S. Leiblinei* should be found to differ essentially in the mode of giving birth to *zoospores* from the American species, the latter will form the type of a new genus.

For the present it seems better, however, to consider the two identical.

Jno. Tomes, F. R. S., London, was chosen a corresponding member of the Department.

Nov. 2d, 1868.

MR. CHAS. BULLOCK in the Chair.

Twenty-six members present.

Mr. T. W. Starr presented to the Department twelve slides, illustrating the anatomy of miscellaneous insects, among which is the seventeen-year locust.

Nov. 16th, 1868.

Director, WM. PEPPER, M. D., in the Chair.

Twenty-six members present.

Mr. W. H. Walmsley donated twelve slides illustrating vegetable structure.

Dr. F. W. Lewis donated slides of miscellaneous objects.

Dr. Woon exhibited to the Department fruiting specimens of a fresh-water *Alga*, which he had found near Cheltenham Hills, Montgomery County, growing in a rapidly flowing creek, on stones, which it covered more or less completely with a dark purplish, mucous coating. He stated that it might be referred, with some doubt, to the European plant, *Chantransia chalybea*, from which it differs, however, in its habit of growth, as well as in the filaments being much thicker and nearly twice as long. He gave the measurements of the oval spores as about $\frac{3}{4} \times \frac{1}{50}$ in the transverse, by $\frac{2}{5} \times \frac{1}{50}$ in the long diameter. The diameter of the filaments is about the $\frac{2}{5} \times \frac{1}{50}$ of an inch.

The doctor also exhibited specimens of a new species of *Palmella*, collected on the banks of the Schuylkill above Manayunk, which grew on the faces of rocks, kept constantly wet by dripping spring water. He proposed for the plant the name of *Palmella Jesseni*, after Prof. Jessen, of Prussia, and gave the following specific description of *P. Jesseni*, n. sp.

P. thallo expanso, initio dilute aut læte viride, molle, pellucidulo, ætate

proecta firmo, tuberculoso, saturate olivaceo viride; cellulis globosis vel ellipticis, in thalli ætate immaturo plerumque singulis aut geminis et sæpe sparsis, in thallo maturo sæpe in familias connexis, plerumque confertis; thalli maturi tegumentis plerumque distinctis, thalli immaturi plerumque diffuentibus.

Diam. cell. glob. max. $\frac{1}{800}$

Cell. oblong. long. max. $\frac{1}{2500}$

Dr. Samuel Lewis was chosen a member of the Department.

Dec. 7th, 1868.

Vice Director, J. G. HUNT, M. D., in the Chair.

Twenty-five members present.

Dr. F. W. Lewis presented to the Department a microscope, with box, bull's eye condensed, two eye pieces and three objectives, including 1 in., $\frac{1}{8}$, and $\frac{1}{12}$, for which the thanks of the Department were formally rendered.

S. Weir Mitchell made the following remarks upon the general resemblance in the effects caused by the venom of the various genera of poisonous serpents.

Several years ago, I reached the conclusion that the bite of the European viper and that of our own rattlesnake, produced identical symptoms. Since then I have been able, from experiments, to extend this conclusion to the copperhead. A very close study of Russel's experiments upon the East Indian snakes, particularly the cobra, and a like analysis of the results obtained by Guyon in Africa, and Ruzf in Martinique, make it probable that all the serpents studied by these observers occasion symptoms which are so much alike as to make it impossible from these alone to state which snake inflicted the wound. The difference is one of degree and never one of kind.

Several months ago I received from Dr. Halford, of Victoria, Australia, a paper on venom poisoning. In replying, I enclosed a dried specimen of rattlesnake poison, with which he made comparative experiments. These appear to confirm the resemblance between the cobra and our own serpents. At the same time Dr. H. states that the tiger-snake differs from the cobra in that its venom occasions but trifling or no local symptoms. He also adds that after death from this serpent's bite, the body does not putrify quickly, but is rather preserved thereby from decomposition. This seems to me so remarkable—so exceptional indeed—as to make it very desirable to have it set beyond doubt by further experiments. Apart from this single case, the identity of all known snake poisons seems to be well established.

Dr. J. G. Hunt exhibited an entire pitcher of the *Nepenthes Disillatoria*, prepared to show the situation of the previously undescribed glands, to which he some months ago called the attention of the Department.

Dr. L. S. Bolles exhibited a new clinical microscope, constructed by Mr. Tolles, of the Boston Optical Works, on a plan proposed by Dr. Cutter of Mass. The microscope possessed a one-fifth objective, and resembled somewhat the tubular part of Dr. Beale's clinical microscope. It was, however, provided with a *screw* movement for the adjustment, which secured a smooth and sufficiently rapid approximation of the object glass towards the object, without the disadvantages so evident in the sliding movement of a tube within a tube. It was unprovided, however, with any special means of illu-

mination, being intended to be used with diffused daylight, or directed towards a source of artificial illumination.

At the annual election for officers held this evening, the following were chosen :—

Director, S. W. Mitchell, M. D.

Vice Director, Wm. Pepper, M. D.

Recorder, James Tyson, M. D.

Corresponding Secretary, J. H. McQuillen, M. D.

Conservator, Herbert Norris, M. D.

Treasurer, C. N. Pierce, D. D. S.

Dec. 21st, 1868.

Director, S. W. MITCHELL, M. D., in the Chair.

Twenty members present.

Dr. J. H. McQuillen exhibited, in further illustration of his previous communication, slides of blood corpuscles of men and lower animals to which chloroform and nitrous oxide had been administered, to show that there was no morphological change in these bodies after administration of anæsthetics, as contended for by B. W. Richardson, Sanson and others. The doctor also exhibited slides of blood corpuscles with which chloroform and ether had been brought in actual contact, producing under these circumstances actual disintegration. Dr. McQ. believes that the anæsthetics act primarily upon the nervous centres, as early contended for by Flourens and the French physiologists generally.

MR. W. H. WALMSLEY called the attention of the Department to the very great merits of Glycerine jelly as a medium for preservation of every description of objects, animal or vegetable, and exhibited specimens of both. I was led to experiment with it about one year ago, owing to the unsatisfactory results obtained from the use of balsam in many classes of objects, its high refracting power rendering many delicate tissues invisible, which are seen perfectly in the jelly. At first I was not very successful, having followed the formulæ of Davies and other English authorities in making it; the intense heat of our early summer liquified it, and spoiled many specimens. After many experiments, I arrived at a satisfactory result, the fluid readily jellying in an hour or two during the hottest days of August.

The advantages of this medium I deem to be various and obvious, and that it combines within itself more than are possessed by any other with which we are as yet acquainted. Its preservative qualities I believe to be unsurpassed, for nearly every description of tissues or structure, animal or vegetable; it preserves the colors of the latter in absolute perfection, it is very readily prepared and used, it attaches the covering glass to the slide with sufficient tenacity for all practical purposes, whilst the finishing ring of varnish will render it quite secure. It is equally available for objects requiring to be mounted in deep cells, and there is no danger of leakage, as is the case with all fluids; it can be readily removed from slide and cover with hot water, if necessary. The refractive powers of the glycerine are sufficient to render all inert structures transparent, whilst even the delicate lines upon the scales of a mosquito's wing, are as distinctly visible as though mounted dry.

Finally, I desire, in bringing the subject before the Department, and mentioning my experience with its use, to interest other members in the matter, to induce them to try it, and to bring together from time to time the results we may severally arrive at. For I conceive it to be almost as important to arrive

at a means of *preserving permanently* objects suitably prepared for scientific observations, as to be able to prepare them for such observation without reference to their preservation. Since we can only hope to arrive at accurate conclusions by repeated study, not by one, but many observers, this can only be done by having the object suitably prepared and permanently preserved.

The formula for making glycerine jelly is as follows:

Take one package of Cox's gelatine, wash repeatedly in *cold* water, then place in a vessel and add sufficiently *cold* water to cover it. Allow it to soak an hour or two, pour off superfluous water, add one pint of *boiling* water, place vessel on fire and boil for ten or fifteen minutes. Remove from fire, and when cool, but still fluid, add the white of an egg, well beaten, replace on the fire and boil until the albumen of the egg coagulates. Strain while hot through flannel, and add an equal portion by *measurement* of Bower's pure glycerine, and fifty drops of carbolic acid in solution; boil again for ten or fifteen minutes, and again strain through flannel, place in water bath, and evaporate to about one-half, then filter into two oz. broad-mouthed vials. (Cotton is the best filtering medium.)

To use the jelly in mounting objects:—Place the stock bottle in a small jar of boiling water; when it becomes fluid, a sufficient quantity must be removed to the slide (previously warmed), with a glass rod; the object, (previously soaked for some hours in equal parts of glycerine and distilled water, with a few drops of alcohol,) is to be placed in the drop of fluid jelly, a cover applied and slight weight placed upon it to exclude superfluous jelly. When cold, clean off the slide with a knife and wash in cold water; finish with a ring of gold size or shellac varnish.

NOTE.—Dr. Carpenter cautions against use of Glycerin with objects of a calcareous nature, as it is a solvent of carbonate of lime.

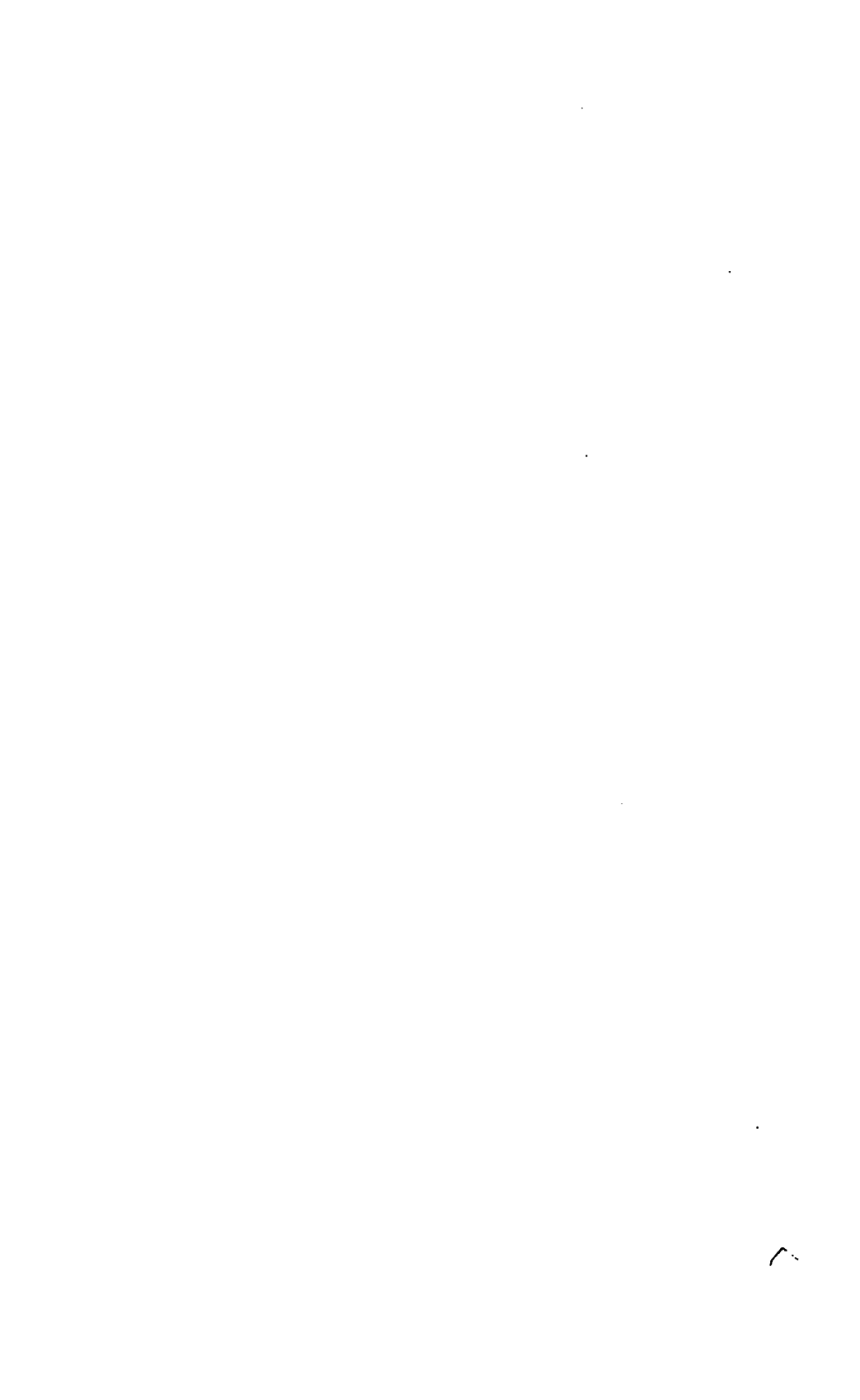
Mr. Chas. Bullock remarked that it is important to give the gelatine frequent washings previous to use, to remove traces of sulphuric acid, which invariably remain from the process employed in its preparation.

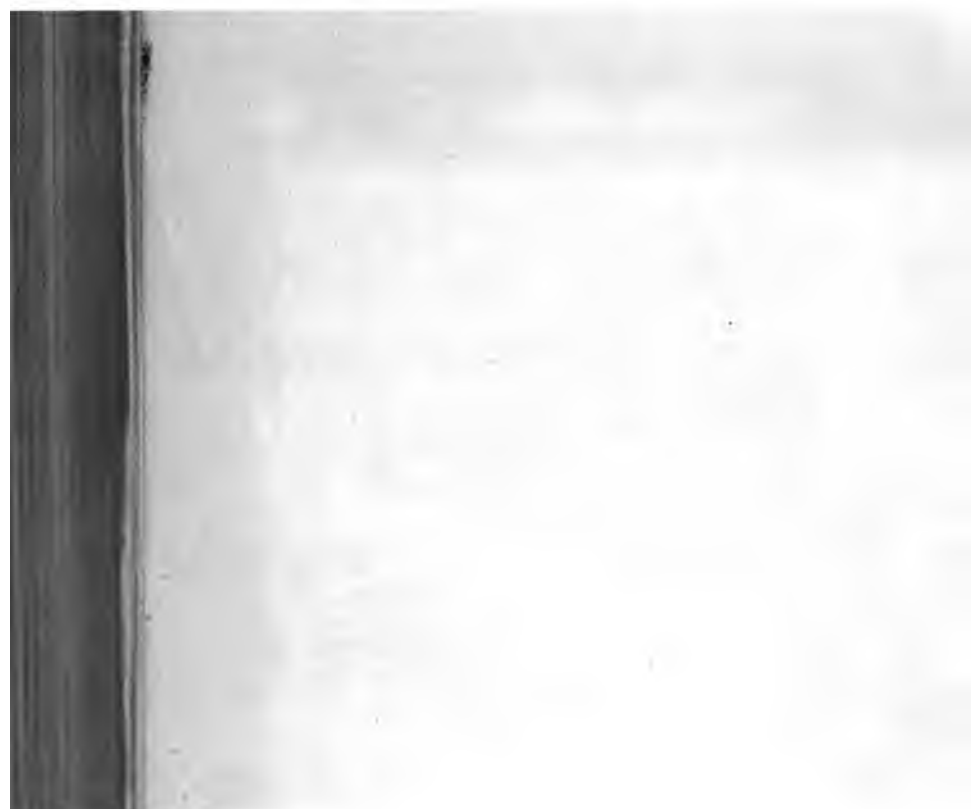
Mitchell W. McAllister, S. Fisher Corlies and Dr. J. G. Richardson, were this evening chosen members of the Department.

Prof. O. W. Holmes, of Boston, was chosen a corresponding member.

INDEX.

| | |
|--|--------------|
| <i>Acarus sacchari</i> , photograph donated..... | 5 |
| Biological and Microscopical Department of Academy of Natural Sciences ; history of organization..... | 1 |
| Blood Corpuscles of animals ; effects of anæsthetics on..... | 14 |
| <i>Chantrausia chalybea</i> | 12 |
| Clinical Microscope, new form of, by Tolles..... | 13 |
| <i>Drosera rotundifolia</i> | 5 |
| Donations to Cabinet..... | 5, 6, 12, 13 |
| Epithelial cancer, slide of, donated | 5 |
| <i>Euglena viridis</i> | 10 |
| Glycerine jelly for mounting objects, and directions to use | 14 |
| Hæmin crystals from fecal matters..... | 3 |
| Hæmato-crystallin, crystals of, to obtain..... | 11 |
| Interglobular spaces in dentine..... | 3 |
| Injected preparations, by Theirsch..... | 4 |
| Mistletoe, section through root of..... | 4 |
| <i>Nepenthes distillatoria</i> , new glands in..... | 5 |
| Nitrous oxide, experiments with inhalation of, and conclusions therefrom | 7, 14 |
| Nobert's most recent test plate, completed set of photographs of donated | 6 |
| Oxygen, effects of inhalation of..... | 8 |
| <i>Palmella Jesseni</i> | 12 |
| <i>Pheronema Annæ</i> | 9 |
| Phosphorus poisoning, structural effects of | 6 |
| Rattles of rattlesnake, growth of..... | 3 |
| Rattlesnakes, sections of fangs of..... | 4 |
| Section Cutter, improved form of..... | 6 |
| <i>Schizomeris Leiblinei</i> ; manner in which it produces its zoospores..... | 11 |
| Venom of serpents, general resemblance in effects of..... | 13 |
| <i>Wolfia Colombiana</i> | 6 |









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